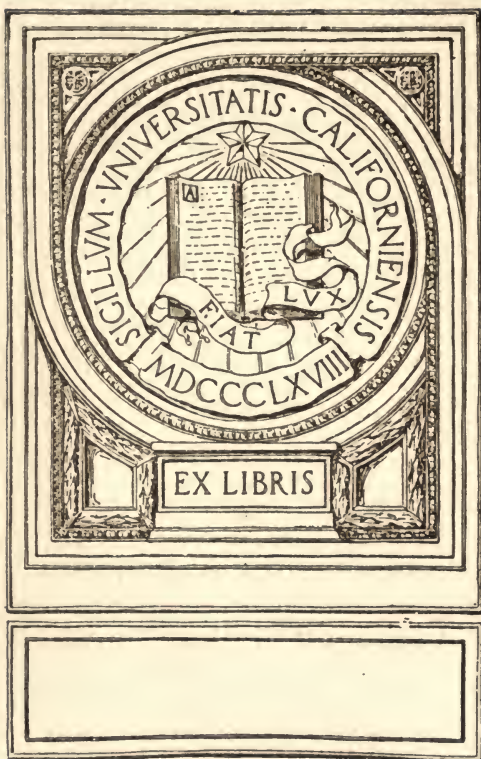


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# CHEMICAL TABLES.

BY

STEPHEN P. SHARPLES, S.B.



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## P R E F A C E .

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THE following work was undertaken at the suggestion of Dr. Wolcott Gibbs, and has been executed under his immediate supervision. No labor has been spared to render the collection of tables as complete as possible, and to insure perfect accuracy in the figures. In all cases the tables have been taken from the original sources, or have been carefully compared with them. The tables on pages 94-99, 100-108, are new, and have been computed expressly for this work: the logarithms at the end of the volume are taken from the well-known five-figure table of August.

Many tables have been introduced, which are not in common use in the laboratory. This has been done partly for the sake of completeness, but principally because the progress of science continually brings the physical and chemical properties of bodies into closer relations with each other. Thus the researches of Landolt have recently shown that the chemical constitution of a mixture or compound may, in many cases, be deduced with accuracy from its optical properties alone.

The tables usually found in works on chemistry, giving the vapor densities of bodies referred to air taken as unity, have been omitted in this work, for the reason that it is always more convenient to refer gases and vapors to hydrogen as the unit of density as well as of weight and volume, and the vapor density is then very simply and directly related to the atomic weight.

The table of wave lengths on page 148 will be found convenient for use in connection with Kirchhoff's chart of the spectrum. With its assistance the wave length of any observed line may be determined with sufficient accuracy by the ordinary methods of interpolation.

The Editor will be greatly obliged for any criticisms or suggestions which may enable him to render the work more perfect in case it should pass to a second edition.

S. P. S.



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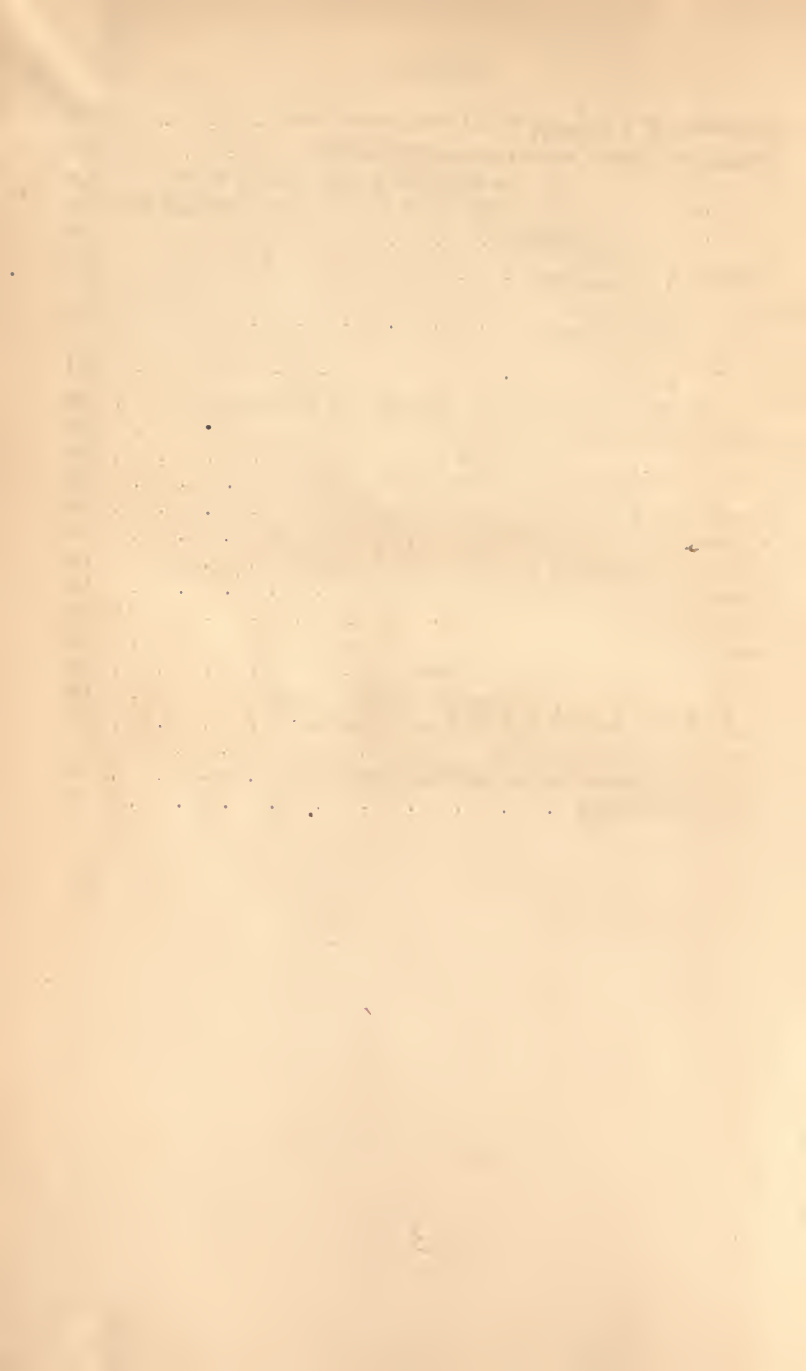
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# TABLES

FOR THE

CALCULATION OF ANALYSES.





# TABLE

## OF THE ELEMENTS AND THEIR EQUIVALENTS.

| Element.   | Symbol. | Equiva-<br>lent. | Log.     | Remarks.                             |
|------------|---------|------------------|----------|--------------------------------------|
| Aluminum   | Al      | 13.75            | 1.138303 |                                      |
| Antimony   | Sb      | 120.00           | 2.079181 | 122 Dexter, 120.3 Schneider.         |
| Arsenic    | As      | 75.00            | 1.875061 |                                      |
| Barium     | Ba      | 68.50            | 1.835691 | 68.59 Marignac.                      |
| Bismuth    | Bi      | 208.00           | 2.318063 |                                      |
| Boron      | B       | 11.00            | 1.041393 | 11.04 Berzelius.                     |
| Bromine    | Br      | 80.00            | 1.903090 | 79.97 Marignac.                      |
| Cadmium    | Cd      | 56.00            | 1.748188 |                                      |
| Cæsium     | Cs      | 133.00           | 1.123852 |                                      |
| Calcium    | Ca      | 20.00            | 1.301030 |                                      |
| Carbon     | C       | 6.00             | 0.778151 |                                      |
| Cerium     | Ce      | 46.00            | 1.662758 |                                      |
| Chlorine   | Cl      | 35.50            | 1.550228 | 35.46 Marignac.                      |
| Chromium   | Cr      | 26.00            | 1.414973 | 26.24 Berlin, Peligot.               |
| Cobalt     | Co      | 30.00            | 1.477121 |                                      |
| Copper     | Cu      | 31.75            | 1.501744 | 31.73 Erdmann & Marchand.            |
| Didymium   | D       | 48.00            | 1.681241 |                                      |
| Erbium     | E       | 56.30            | 1.750508 |                                      |
| Fluorine   | F       | 19.00            | 1.278754 |                                      |
| Glucinum   | G       | 4.66             | 0.668386 |                                      |
| Gold       | Au      | 197.00           | 2.294466 | 196.67 Berzelius.                    |
| Hydrogen   | H       | 1.00             | 0.000000 |                                      |
| Indium     | In      | 37.00            | 1.568202 |                                      |
| Iodine     | I       | 127.00           | 2.103804 |                                      |
| Iridium    | Ir      | 98.00            | 1.991226 |                                      |
| Iron       | Fe      | 28.00            | 1.447158 |                                      |
| Lanthanum  | La      | 47.00            | 1.672098 | 46.4 Holzmann.                       |
| Lead       | Pb      | 103.50           | 2.014940 | 103.57 Berzelius.                    |
| Lithium    | L       | 7.00             | 0.845098 | 6.95 Mallet.                         |
| Magnesium  | Mg      | 12.00            | 1.079181 | [Hauer.                              |
| Manganese  | Mn      | 27.00            | 1.431364 | 27.57 Berzelius, 27.5 Von            |
| Mercury    | Hg      | 100.00           | 2.000000 | 100.05 Erdmann & Marchand.           |
| Molybdenum | Mo      | 46.00            | 1.662758 |                                      |
| Nickel     | Ni      | 29.00            | 1.462398 |                                      |
| Niobium    | Nb      | 94.00            | 1.973128 | When NbO <sub>5</sub> = Niobic acid. |
| Nitrogen   | N       | 14.00            | 1.146128 |                                      |

| Element.   | Symbol. | Equiva-<br>lent. | Log.     | Remarks.                              |
|------------|---------|------------------|----------|---------------------------------------|
| Osmium     | Os      | 97.00            | 1.986772 | 99.82 Fremy.                          |
| Oxygen     | O       | 8.00             | 0.903090 |                                       |
| Palladium  | Pd      | 53.20            | 1.725912 | 53.24 Berzelius.                      |
| Phosphorus | P       | 31.00            | 1.491362 |                                       |
| Platinum   | Pt      | 99.00            | 1.995635 | 98.94 Andrews.                        |
| Potassium  | K       | 39.00            | 1.591065 | 39.11 Marignac.                       |
| Rhodium    | R       | 52.00            | 1.716003 | 52.16 Berzelius.                      |
| Rubidium   | Rb      | 85.40            | 1.931458 |                                       |
| Ruthenium  | Ru      | 52.00            | 1.716003 |                                       |
| Selenium   | Se      | 39.50            | 1.596597 | 39.41 Erdmann & Marchand.             |
| Silicon    | Si      | 14.00            | 1.146128 | When Silicic acid = $\text{SiO}_2$ .  |
| Silver     | Ag      | 108.00           | 2.033424 |                                       |
| Sodium     | Na      | 23.00            | 1.361728 | [louze.                               |
| Strontium  | Sr      | 43.75            | 1.640978 | 43.67 Stromeyer, 43.85 Pe-            |
| Sulphur    | S       | 16.00            | 1.204120 |                                       |
| Tantalum   | Ta      | 172.00           | 2.235528 | When Tantalac acid = $\text{TaO}_5$ . |
| Tellurium  | Te      | 64.00            | 1.806180 | 64.14 Berzelius.                      |
| Thallium   | Tl      | 204.00           | 2.309630 |                                       |
| Thorium    | Th      | 118.00           | 2.071882 | When Thoria = $\text{ThO}_2$ .        |
| Tin        | Sn      | 58.00            | 1.763428 |                                       |
| Titanium   | Ti      | 25.00            | 1.397940 |                                       |
| Tungsten   | W       | 92.00            | 1.963788 |                                       |
| Uranium    | U       | 60.00            | 1.778151 |                                       |
| Vanadium   | V       | 68.50            | 1.835691 | 68.54 Berzelius.                      |
| Yttrium    | Y       | 30.85            | 1.489255 |                                       |
| Zinc       | Zn      | 32.50            | 1.511883 | 32.52 Axel, Erdmann.                  |
| Zirconium  | Zr      | 44.80            | 1.651278 | When Zirconia = $\text{ZrO}_2$ .      |



## TABLE

GIVING THE ELEMENTS ARRANGED IN NATURAL GROUPS; WITH  
THEIR MOLECULAR AND ATOMIC WEIGHTS.

1. *Monatomic Elements, or Elements usually equivalent to 1 Atom  
of Hydrogen.*

| Element. | Atomic Weight. | Molecular Weight. | Element.  | Atomic Weight. | Molecular Weight. |
|----------|----------------|-------------------|-----------|----------------|-------------------|
| Bromine  | 80.00          | 160.00            | Lithium   | 7.00           | 14.00             |
| Chlorine | 35.50          | 71.00             | Potassium | 39.00          | 78.00             |
| Cæsium   | 133.00         | 266.00            | Rubidium  | 85.40          | 170.80            |
| Fluorine | 19.00          | 38.00             | Silver    | 108.00         | 216.00            |
| Gold     | 197.00         | 394.00            | Sodium    | 23.00          | 46.00             |
| Hydrogen | 1.00           | 2.00              | Thallium  | 204.00         | 408.00            |
| Iodine   | 127.00         | 254.00            |           |                |                   |

2. *Diatomic Elements, or Elements usually equivalent to 2 Atoms  
of Hydrogen.*

| Element.  | Atomic Weight. | Molecular Weight. | Element.  | Atomic Weight. | Molecular Weight. |
|-----------|----------------|-------------------|-----------|----------------|-------------------|
| Oxygen    | 16.00          | 32.00             | Indium ?  | 74.00          | 148.00            |
| Sulphur   | 32.00          | 64.00             | Cobalt    | 60.00          | 120.00            |
| Selenium  | 79.00          | 158.00            | Nickel    | 58.00          | 116.00            |
| Tellurium | 128.00         | 256.00            | Cadmium   | 112.00         | 224.00            |
| Calcium   | 40.00          | 80.00             | Copper    | 63.50          | 127.00            |
| Barium    | 137.00         | 274.00            | Mercury   | 200.00         | 400.00            |
| Strontium | 87.50          | 175.00            | Cerium    | 92.00          | 184.00            |
| Lead      | 207.00         | 414.00            | Didymium  | 96.00          | 192.00            |
| Iron      | 56.00          | 112.00            | Lanthanum | 94.00          | 188.00            |
| Manganese | 54.00          | 108.00            | Yttrium   | 61.70          | 123.40            |
| Chromium  | 52.00          | 104.00            | Erbium    | 112.60         | 225.20            |
| Aluminum  | 27.50          | 55.00             | Glucinum  | 9.32           | 18.64             |
| Zinc      | 65.00          | 130.00            | Uranium   | 120.00         | 240.00            |
| Magnesium | 24.00          | 48.00             |           |                |                   |

3. *Triatomic Elements, or Elements usually equivalent to 3 Atoms  
of Hydrogen.*

| Element.   | Atomic Weight. | Molecular Weight. | Element.     | Atomic Weight. | Molecular Weight. |
|------------|----------------|-------------------|--------------|----------------|-------------------|
| Nitrogen   | 14.00          | 28.00             | Boron        | 11.00          | ?                 |
| Phosphorus | 31.00          | 124.00            | Molybdenum ? | 92.00          | ?                 |
| Arsenic    | 75.00          | 300.00            | Tungsten ?   | 184.00         | ?                 |
| Antimony   | 120.00         | 480.00            | Vanadium ?   | 137.00         | ?                 |
| Bismuth    | 208.00         | 832.00            |              |                |                   |



4. *Tetratomic Elements, or Elements usually equivalent to 4 Atoms of Hydrogen.*

| Element.  | Atomic Weight. | Molecular Weight. | Element.  | Atomic Weight. | Molecular Weight. |
|-----------|----------------|-------------------|-----------|----------------|-------------------|
| Carbon    | 12.00          | 24.00 ?           | Osmium    | 194.00         | 388.00 ?          |
| Silicon   | 28.00          | 56.00 ?           | Palladium | 106.40         | 212.80 ?          |
| Zirconium | 89.60          | 179.20 ?          | Platinum  | 198.00         | 396.00 ?          |
| Thorium   | 236.00         | 472.00 ?          | Iridium   | 196.00         | 392.00 ?          |
| Tin       | 116.00         | 232.00 ?          | Rhodium   | 104.00         | 208.00 ?          |
| Titanium  | 50.00          | 100.00 ?          | Ruthenium | 104.00         | 208.00 ?          |

5. *Pentatomic Elements, or Elements usually equivalent to 5 Atoms of Hydrogen.*

| Element. | Atomic Weight. | Molecular Weight. | Element. | Atomic Weight. | Molecular Weight. |
|----------|----------------|-------------------|----------|----------------|-------------------|
| Tantalum | 344.00         | 688.00 ?          | Niobium  | 198.00         | 396.00 ?          |

TABLE

OF THE FORMULAS, EQUIVALENTS, AND PER CENTS OF THE CONSTITUENTS, OF THE MOST FREQUENTLY OCCURRING COMPOUNDS.

| Combination           | Formula.                              | Equiva-<br>lent. | Per cent of Constituents.                                                                                                                                                                                                                                                  |
|-----------------------|---------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bromides.</b>      |                                       |                  |                                                                                                                                                                                                                                                                            |
| Bromide of Potassium  | KBr                                   | 119.00           | K 32.77 Br 67.23                                                                                                                                                                                                                                                           |
| " Silver              | AgBr                                  | 188.00           | Ag 57.45 Br 42.55                                                                                                                                                                                                                                                          |
| " Sodium              | NaBr                                  | 103.00           | Na 22.33 Br 77.67                                                                                                                                                                                                                                                          |
| <b>Chlorides.</b>     |                                       |                  |                                                                                                                                                                                                                                                                            |
| Chloride of Ammonium  | NH <sub>4</sub> Cl                    | 53.50            | { NH <sub>4</sub> 33.65 Cl 66.35<br>NH <sub>3</sub> 31.78 HCl 68.22<br>NH <sub>4</sub> 8.06 Pt 44.29 Cl 47.65 ; or,<br>NH <sub>4</sub> Cl 23.94 PtCl <sub>2</sub> 76.06 ; or,<br>NH <sub>3</sub> 7.60 HCl 16.34 PtCl <sub>2</sub> 76.06<br>N 6.26 H 1.79 Cl 47.65 Pt 44.30 |
| " Ammonium & Platinum | NH <sub>4</sub> Cl, PtCl <sub>2</sub> | 223.50           |                                                                                                                                                                                                                                                                            |
| " Barium              | BaCl                                  | 104.00           | Ba 65.86 Cl 34.14                                                                                                                                                                                                                                                          |
| " " Crystal.          | BaCl + 2HO                            | 122.00           | Ba 56.15 Cl 29.09 HO 14.76                                                                                                                                                                                                                                                 |
| " Calcium             | CaCl                                  | 55.50            | Ca 36.04 Cl 63.96                                                                                                                                                                                                                                                          |
| " Cobalt              | CoCl                                  | 65.50            | Co 45.80 Cl 54.20                                                                                                                                                                                                                                                          |
| " " Crystal.          | CoCl + 6HO                            | 119.50           | Co 25.10 Cl 29.71 HO 45.19                                                                                                                                                                                                                                                 |
| " Copper              | CuCl                                  | 67.25            | Cu 47.21 Cl 52.79                                                                                                                                                                                                                                                          |
| " " Sub               | Cu <sub>2</sub> Cl                    | 99.00            | Cu 64.15 Cl 35.85                                                                                                                                                                                                                                                          |
| " Gold                | AuCl <sub>3</sub>                     | 303.50           | Au 64.91 Cl 35.09                                                                                                                                                                                                                                                          |
| " Iron Proto          | FeCl                                  | 63.50            | Fe 44.10 Cl 55.90                                                                                                                                                                                                                                                          |
| " " Sesqui            | Fe <sub>2</sub> Cl <sub>3</sub>       | 162.50           | Fe 34.46 Cl 65.54                                                                                                                                                                                                                                                          |

| Combination.               | Formula.                              | Equiva-<br>lent. | Per cent of Constituents.                                              |
|----------------------------|---------------------------------------|------------------|------------------------------------------------------------------------|
| Chloride of Lead           | PbCl                                  | 139.00           | Pb 74.46 Cl 25.54                                                      |
| " Magnesium                | MgCl                                  | 47.50            | Mg 25.26 Cl 74.74                                                      |
| " Manganese                | MnCl                                  | 62.50            | Mn 43.20 Cl 56.80                                                      |
| " " Crystal.               | MnCl + 4HO                            | 98.50            | Mn 27.41 Cl 36.04 HO 36.55                                             |
| " Mercury                  | HgCl                                  | 135.50           | Hg 73.80 Cl 26.20                                                      |
| " " Sub                    | Hg <sub>2</sub> Cl                    | 235.50           | Hg 84.92 Cl 15.08                                                      |
| " Platinum                 | PtCl                                  | 134.50           | Pt 73.61 Cl 26.39                                                      |
| " " Bi                     | PtCl <sub>2</sub>                     | 170.00           | Pt 58.23 Cl 41.77                                                      |
| " Potassium                | KCl                                   | 74.50            | K 52.35 Cl 47.65                                                       |
| " " & Platinum             | KCl, PtCl <sub>2</sub>                | 244.50           | { KCl 30.47 PtCl <sub>2</sub> 69.53 ; or,<br>K 15.95 Pt 40.49 Cl 43.56 |
| " Silver                   | AgCl                                  | 143.50           | Ag 75.26 Cl 24.74                                                      |
| " Sodium                   | NaCl                                  | 58.50            | Na 39.32 Cl 60.68                                                      |
| " Tin Bi                   | SnCl <sub>2</sub>                     | 129.00           | Sn 44.96 Cl 55.04                                                      |
| " " Crystal.               | SnCl + 2HO                            | 111.50           | Sn 52.02 Cl 31.84 HO 16.14                                             |
| " " Proto                  | SnCl                                  | 93.50            | Sn 62.03 Cl 37.97                                                      |
| " Zinc                     | ZnCl                                  | 68.00            | Zn 47.79 Cl 52.21                                                      |
| <b>Cyanides.</b>           |                                       |                  |                                                                        |
| Cyanogen = Cy              | C <sub>2</sub> N                      | 26.00            | C 46.15 N 53.85                                                        |
| Cyanide of Mercury         | Hg <sub>2</sub> Cy                    | 126.00           | Hg 79.36 Cy 20.64                                                      |
| " Palladium                | PdCy                                  | 79.20            | Pd 67.18 Cy 32.82                                                      |
| " Potassium                | KCy                                   | 65.00            | K 60.00 Cy 40.00                                                       |
| " Silver                   | AgCy                                  | 134.00           | Ag 80.59 Cy 19.41                                                      |
| Ferricyanide of Potassium  | 3KCy, Fe <sub>2</sub> Cy <sub>3</sub> | 329.00           | KCy 59.27 Fe <sub>2</sub> Cy <sub>3</sub> 40.73                        |
| Ferrocyanide of Potassium  | 2KCy, FeCy + 3HO                      | 211.00           | KCy 61.61 FeCy 25.59 HO 12.80                                          |
| Sulphocyanide of Potassium | KCyS <sub>2</sub>                     | 97.00            | K 40.20 Cy 26.81 S 32.99                                               |

|                        |                                      | Fluorides. |                                             |
|------------------------|--------------------------------------|------------|---------------------------------------------|
| Fluoride of Ammonium   | $\text{NH}_4\text{F}$                | 37.00      | $\text{NH}_4$ 48.65 F 51.35                 |
| “ Calcium              | $\text{CaF}$                         | 39.00      | $\text{Ca}$ 51.28 F 48.72                   |
| “ Sodium & Aluminum    | $3\text{NaF}, \text{Al}_2\text{F}_3$ | 210.50     | $\text{Na}$ 32.77 $\text{Al}$ 13.06 F 54.17 |
| “ Potassium            | $\text{KF}$                          | 58.00      | $\text{K}$ 67.24 F 32.76                    |
| “ Sodium               | $\text{NaF}$                         | 42.00      | $\text{Na}$ 54.76 F 45.24                   |
| Fluosilicate of Barium | $\text{BaF}, \text{BF}_3$            | 139.50     | $\text{Ba}$ 49.10 $\text{Si}$ 10.04 F 40.86 |
| “ Potassium            | $\text{KF}, \text{SiF}_2$            | 110.00     | $\text{K}$ 35.45 $\text{Si}$ 12.73 F 51.82  |
| Fluoborate of “        | $\text{KF}, \text{BF}_3$             | 126.00     | $\text{K}$ 30.95 $\text{B}$ 8.73 F 60.32    |
| Compounds of Hydrogen. |                                      |            |                                             |
| Hydrobromic acid       | $\text{HBr}$                         | 81.00      | $\text{H}$ 1.24 $\text{Br}$ 98.76           |
| Hydrochloric “         | $\text{HCl}$                         | 36.50      | $\text{H}$ 2.74 $\text{Cl}$ 97.26           |
| Hydrocyanic “          | $\text{HCy}$                         | 27.00      | $\text{H}$ 3.71 $\text{Cy}$ 96.29           |
| Hydrofluoric “         | $\text{HF}$                          | 20.00      | $\text{H}$ 5.00 $\text{F}$ 95.00            |
| Hydroiodic “           | $\text{HI}$                          | 128.00     | $\text{H}$ 0.78 $\text{I}$ 99.22            |
| Hydrosulphuric acid    | $\text{HS}$                          | 17.00      | $\text{H}$ 5.88 $\text{S}$ 94.12            |
| Ammonia                | $\text{NH}_3$                        | 17.00      | $\text{H}$ 17.65 $\text{N}$ 82.35           |
| Iodides.               |                                      |            |                                             |
| Iodide of Copper (Sub) | $\text{Cu}_2\text{I}$                | 190.50     | $\text{Cu}$ 33.34 $\text{I}$ 66.66          |
| “ Mercury              | $\text{HgI}$                         | 227.00     | $\text{Hg}$ 44.06 $\text{I}$ 55.94          |
| “ Palladium            | $\text{PdI}$                         | 180.20     | $\text{Pd}$ 29.58 $\text{I}$ 70.42          |
| “ Potassium            | $\text{KI}$                          | 166.00     | $\text{K}$ 23.48 $\text{I}$ 76.52           |
| “ Silver               | $\text{AgI}$                         | 235.00     | $\text{Ag}$ 45.96 $\text{I}$ 54.04          |
| “ Sodium               | $\text{NaI}$                         | 150.00     | $\text{Na}$ 15.34 $\text{I}$ 84.66          |
| Oxides.                |                                      |            |                                             |
| Aluminum, Oxide        | $\text{Al}_2\text{O}_3$              | 51.50      | $\text{Al}$ 53.40 $\text{O}$ 46.60          |
| Ammonium, Oxide        | $\text{NH}_4\text{O}$                | 26.00      | $\text{NH}_4$ 69.23 $\text{O}$ 30.77        |
| Antimony, Oxide        | $\text{SbO}_4$                       | 144.00     | $\text{Sb}$ 83.35 $\text{O}$ 16.65          |

| Combination.               | Formula.                   | Equiva-<br>lent. | Per cent of Constituents. |
|----------------------------|----------------------------|------------------|---------------------------|
| Antimonous Acid            | $\text{SbO}_4$             | 152.00           | Sb 78.96 O 21.04          |
| Antimonous Acid            | $\text{SbO}_5$             | 160.00           | Sb 75.01 O 24.99          |
| Arsenous Acid              | $\text{AsO}_3$             | 99.00            | As 75.76 O 24.24          |
| Arsenic Acid               | $\text{AsO}_5$             | 115.00           | As 65.22 O 34.78          |
| Barium, Oxide              | $\text{BaO}$               | 76.50            | Ba 89.55 O 10.45          |
| “ Hydrate                  | $\text{BaO, HO}$           | 85.50            | BaO 89.48 HO 10.52        |
| “ Peroxide                 | $\text{BaO}_2$             | 84.50            | Ba 81.06 O 18.94          |
| Bismuth, Oxide             | $\text{BiO}_3$             | 232.00           | Bi 89.65 O 10.35          |
| Boric Acid                 | $\text{BO}_3$              | 35.00            | B 31.43 O 68.57           |
| “ “ Crystal.               | $\text{BO}_3 + 3\text{HO}$ | 62.00            | BO 56.44 HO 43.56         |
| Cadmium, Oxide             | $\text{CdO}$               | 64.00            | Cd 87.50 O 12.50          |
| Calcium “                  | $\text{CaO}$               | 28.00            | Ca 71.43 O 28.57          |
| “ Hydrate                  | $\text{CaO, HO}$           | 37.00            | CaO 75.67 HO 24.33        |
| Carbonic Oxide             | $\text{CO}$                | 14.00            | C 42.86 O 57.14           |
| “ Acid                     | $\text{CO}_2$              | 22.00            | C 27.27 O 72.73           |
| Chloric Acid               | $\text{ClO}_5$             | 75.50            | Cl 47.02 O 52.98          |
| Chromic Acid               | $\text{CrO}_3$             | 50.00            | Cr 52.00 O 48.00          |
| Chromium, Sesquioxide      | $\text{Cr}_2\text{O}_3$    | 76.00            | Cr 68.42 O 31.58          |
| Cobalt, Oxide              | $\text{CoO}$               | 38.00            | Co 78.94 O 21.06          |
| “ Sesquioxide              | $\text{Co}_2\text{O}_3$    | 84.00            | Co 71.43 O 28.57          |
| Cobalt, Protos Sesquioxide | $\text{Co}_3\text{O}_4$    | 122.00           | Co 73.77 O 26.23          |
| Copper, Oxide              | $\text{CuO}$               | 39.75            | Cu 79.88 O 20.12          |
| “ Suboxide                 | $\text{Cu}_2\text{O}$      | 71.50            | Cu 88.81 O 11.19          |
| Gold, Teroxide             | $\text{AuO}$               | 221.00           | Au 89.14 O 10.86          |
| Hydrogen, Oxide            | $\text{HO}$                | 9.00             | H 11.11 O 88.89           |
| “ Peroxide                 | $\text{HO}_2$              | 17.00            | H 5.88 O 94.12            |
| Iodic Acid                 | $\text{IO}_5$              | 167.00           | I 76.05 O 23.95           |
| Iron, Oxide                | $\text{FeO}$               | 36.00            | Fe 77.78 O 22.22          |

|                         |                                     |        |                     |                     |
|-------------------------|-------------------------------------|--------|---------------------|---------------------|
| Iron, Sesquioxide       | $\text{Fe}_2\text{O}_3$             | 80.00  | Fe 70.00            | O 30.00             |
| “ Magnetic Oxide        | $\text{Fe}_3\text{O}_4$             | 116.00 | Fe 72.41            | O 27.59             |
| Lead, Suboxide          | $\text{Pb}_2\text{O}$               | 215.00 | Pb 96.28            | O 3.72              |
| “ Oxide                 | $\text{PbO}$                        | 111.50 | Pb 92.83            | O 7.17              |
| “ Peroxide              | $\text{PbO}_2$                      | 119.50 | Pb 86.61            | O 13.39             |
| Magnesium, Oxide        | $\text{MgO}$                        | 20.00  | Mg 60.00            | O 40.00             |
| “ Hydrate               | $\text{MgO}, \text{HO}$             | 29.00  | MgO 68.97           | HO 31.03            |
| Manganese, Oxide        | $\text{MnO}$                        | 35.00  | Mn 77.14            | O 22.86             |
| “ Sesquioxide           | $\text{Mn}_2\text{O}_3$             | 78.00  | Mn 69.23            | O 30.77             |
| “ Protos Sesquioxide    | $\text{Mn}_3\text{O}_4$             | 113.00 | Mn 71.68            | O 28.32             |
| “ Peroxide              | $\text{MnO}_2$                      | 43.00  | Mn 62.79            | O 37.21             |
| Manganic Acid           | $\text{MnO}_3$                      | 51.00  | Mn 52.94            | O 47.06             |
| Pernanganic Acid        | $\text{Mn}_2\text{O}_7$             | 110.00 | Mn 49.09            | O 50.91             |
| Mercury, Oxide          | $\text{HgO}$                        | 108.00 | Hg 92.59            | O 7.41              |
| “ Suboxide              | $\text{Hg}_2\text{O}$               | 208.00 | Hg 96.15            | O 3.85              |
| Molybdic Acid           | $\text{MoO}_3$                      | 70.00  | Mo 65.71            | O 34.29             |
| Nickel, Oxide           | $\text{NiO}$                        | 37.00  | Ni 78.38            | O 21.62             |
| Nitrogen, Oxide         | $\text{NO}$                         | 22.00  | N 63.64             | O 36.36             |
| “ Deutoxide             | $\text{NO}_2$                       | 30.00  | N 46.67             | O 53.33             |
| Nitrous Acid            | $\text{NO}_3$                       | 38.00  | N 36.84             | O 63.16             |
| Nitric Acid             | $\text{NO}_5$                       | 54.00  | N 25.93             | O 74.07             |
| “ “ Hydrate             | $\text{HO}, \text{NO}_5$            | 63.00  | $\text{NO}_5$ 85.71 | HO 14.29            |
| Oxalic Acid             | $\text{C}_2\text{O}_3$              | 36.00  | C 33.33             | O 66.67             |
| “ “ Crystal.            | $\text{C}_2\text{O}_3 + 3\text{HO}$ | 63.00  | O 57.14             | HO 42.86            |
| Phosphoric Acid         | $\text{PO}_5$                       | 71.00  | P 43.66             | O 56.34             |
| “ “ Hydrated            | $\text{HO}, \text{PO}_5$            | 80.00  | HO 11.25            | $\text{PO}_5$ 88.75 |
| Pyrophosphoric Acid     | $2\text{HO}, \text{PO}_5$           | 89.00  | HO 20.23            | $\text{PO}_5$ 79.77 |
| Phosphoric Acid, common | $3\text{HO}, \text{PO}_5$           | 98.00  | HO 27.55            | $\text{PO}_5$ 72.45 |
| Platinum, Binoxide      | $\text{PtO}_2$                      | 115.00 | Pt 86.08            | O 13.92             |
| Potassium, Oxide        | $\text{KO}$                         | 47.00  | K 82.94             | O 17.06             |



| Combination.          | Formula.                      | Equiva-<br>lent. | Per cent of Constituents.     |
|-----------------------|-------------------------------|------------------|-------------------------------|
| Potassium, Hydrate.   | KO, HO                        | 56.00            | KO 83.93 HO 16.07             |
| Silicic Acid          | SiO <sub>2</sub>              | 30.00            | Si 46.67 O 53.33              |
| Silver, Oxide         | Ag <sub>2</sub> O             | 116.00           | Ag 93.10 O 6.90               |
| Sodium, Oxide         | Na <sub>2</sub> O             | 31.00            | Na 74.19 O 25.81              |
| “ Hydrate             | NaO, HO                       | 40.00            | Na 77.50 HO 22.50             |
| Strontium, Oxide      | SrO                           | 51.75            | Sr 84.54 O 15.46              |
| Sulphuric Acid        | SO <sub>3</sub>               | 40.00            | S 40.00 O 60.00               |
| “ Hydrate             | HO, SO <sub>3</sub>           | 49.00            | SO <sub>3</sub> 81.63 O 18.37 |
| Sulphurous Acid       | SO <sub>2</sub>               | 32.00            | S 50.00 O 50.00               |
| Stannic Acid          | SnO <sub>2</sub>              | 74.00            | Sn 78.38 O 21.62              |
| Tin, Oxide            | SnO                           | 66.00            | Sn 87.88 O 12.12              |
| Titanic Acid          | TiO <sub>2</sub>              | 41.00            | Ti 60.98 O 39.02              |
| Uranium, Oxide        | UO                            | 68.00            | U 88.24 O 11.76               |
| “ Sesquioxide         | U <sub>2</sub> O <sub>3</sub> | 144.00           | U 83.33 O 16.67               |
| “ Protos Sesquioxide  | U <sub>3</sub> O <sub>4</sub> | 212.00           | U 84.91 O 15.09               |
| Zinc, Oxide           | ZnO                           | 40.50            | Zn 80.24 O 19.76              |
| <b>Sulphides.</b>     |                               |                  |                               |
| Ammonium, Sulphide    | NH <sub>4</sub> S             | 34.00            | NH <sub>4</sub> 52.94 S 47.06 |
| Antimony, Tersulphide | SbS <sub>3</sub>              | 168.00           | Sb 71.43 S 28.57              |
| “ Pentasulphide       | SbS <sub>5</sub>              | 200.00           | Sb 60.00 S 40.00              |
| Arsenic, Bisulphide   | AsS <sub>2</sub>              | 107.00           | As 70.09 S 29.91              |
| “ Tersulphide         | AsS <sub>3</sub>              | 123.00           | As 60.98 S 39.02              |
| “ Pentasulphide       | AsS <sub>5</sub>              | 155.00           | As 48.39 S 51.61              |
| Cadmium, Sulphide     | CdS                           | 72.00            | Cd 77.78 S 22.22              |
| Carbon, Bisulphide    | CS <sub>2</sub>               | 38.00            | C 15.79 S 84.21               |
| Copper, Sulphide      | CuS                           | 47.75            | Cu 66.49 S 33.51              |

|                      |                      | Acetates.                   |                                    |
|----------------------|----------------------|-----------------------------|------------------------------------|
|                      |                      | $\bar{A} = C_4H_3O_3 = 51.$ |                                    |
| Copper, Subsulphide  | $Cu_2S$              | 79.50                       | Cu 79.87 S 20.13                   |
| Iron, Sulphide       | FeS                  | 44.00                       | Fe 63.64 S 36.36                   |
| “ Bisulphide         | FeS <sub>2</sub>     | 60.00                       | Fe 46.67 S 53.33                   |
| Lead, Sulphide       | PbS                  | 119.50                      | Pb 86.61 S 13.39                   |
| Mercury, Sulphide    | HgS                  | 116.00                      | Hg 86.21 S 13.79                   |
| Molybdenum, Sulphide | MoS <sub>2</sub>     | 78.00                       | Mo 58.97 S 41.03                   |
| Potassium, “         | KS                   | 55.00                       | K 70.91 S 29.09                    |
| “ Tersulphide        | KS <sub>3</sub>      | 87.00                       | K 44.83 S 55.17                    |
| “ Pentasulphide      | KS <sub>5</sub>      | 119.00                      | K 32.77 S 67.23                    |
| Silver, Sulphide     | AgS                  | 124.00                      | Ag 87.09 S 12.91                   |
| Sodium, “            | NaS                  | 39.00                       | Na 58.97 S 41.03                   |
| “ Tersulphide        | NaS <sub>3</sub>     | 71.00                       | Na 32.39 S 67.61                   |
| “ Pentasulphide      | NaS <sub>5</sub>     | 103.00                      | Na 22.33 S 77.67                   |
| Tin, Sulphide        | SnS                  | 74.00                       | Sn 78.38 S 21.62                   |
| “ Bisulphide         | SnS <sub>2</sub>     | 90.00                       | Sn 64.44 S 35.56                   |
| Zinc, Sulphide       | ZnS                  | 48.50                       | Zn 67.01 S 32.99                   |
|                      |                      |                             |                                    |
| Base.                |                      |                             |                                    |
| Copper               | $CuO, \bar{A} + HO$  | 99.75                       | CuO 39.85 $\bar{A}$ 51.13 HO 9.02  |
| Lead                 | $PbO, \bar{A} + 3HO$ | 189.50                      | PbO 58.84 $\bar{A}$ 26.91 HO 14.25 |
| Potassium            | $KO, \bar{A}$        | 98.00                       | KO 47.99 $\bar{A}$ 52.01           |
| Silver               | $AgO, \bar{A}$       | 167.00                      | Ag 69.46 $\bar{A}$ 30.54           |
| Sodium               | $NaO, \bar{A} + 6HO$ | 136.00                      | NaO 22.79 $\bar{A}$ 37.50 HO 39.71 |
|                      |                      |                             |                                    |
|                      |                      |                             |                                    |
|                      |                      |                             |                                    |
|                      |                      | Borates.                    |                                    |
| Sodium, Bi-          | $NaO, 2BoO_3$        | 101.00                      | NaO 30.70 $Bo_3$ 69.30             |
| “ Crystallized       | $NaO, 2BoO_3 + 10HO$ | 191.00                      | NaO 16.23 $Bo_3$ 36.65 HO 47.12    |



| Base.              | Formula.                                | Equiva-<br>lent. | Per cent of Constituents.                                |
|--------------------|-----------------------------------------|------------------|----------------------------------------------------------|
| <b>Carbonates.</b> |                                         |                  |                                                          |
| Ammonium, Sesqui   | $2\text{NH}_4\text{O}, 3\text{CO}_2$    | 118.00           | $\text{NH}_4\text{O}$ 44.07 $\text{CO}_2$ 55.93          |
| “ Neutral          | $\text{NH}_4\text{O}, \text{CO}_2$      | 48.00            | $\text{NH}_4\text{O}$ 54.17 $\text{CO}_2$ 45.83          |
| Barium             | $\text{BaO}, \text{CO}_2$               | 98.50            | $\text{BaO}$ 77.66 $\text{CO}_2$ 22.34                   |
| Calcium            | $\text{CaO}, \text{CO}_2$               | 50.00            | $\text{CaO}$ 56.00 $\text{CO}_2$ 44.00                   |
| Iron               | $\text{FeO}, \text{CO}_2$               | 58.00            | $\text{FeO}$ 62.07 $\text{CO}_2$ 37.93                   |
| Magnesium          | $\text{MgO}, \text{CO}_2$               | 42.00            | $\text{MgO}$ 47.62 $\text{CO}_2$ 52.38                   |
| Manganese          | $\text{MnO}, \text{CO}_2$               | 57.00            | $\text{MnO}$ 61.40 $\text{CO}_2$ 38.60                   |
| Lead               | $\text{PbO}, \text{CO}_2$               | 133.50           | $\text{PbO}$ 83.52 $\text{CO}_2$ 16.48                   |
| Potassium          | $\text{KO}, \text{CO}_2$                | 69.00            | $\text{KO}$ 68.12 $\text{CO}_2$ 31.88                    |
| “ Bi               | $\text{KO}, 2\text{CO}_2 + \text{HO}$   | 100.00           | $\text{KO}$ 47.00 $\text{CO}_2$ 44.00 $\text{HO}$ 9.00   |
| Sodium             | $\text{NaO}, \text{CO}_2$               | 53.00            | $\text{NaO}$ 58.49 $\text{CO}_2$ 41.51                   |
| “ Crystal.         | $\text{NaO}, \text{CO}_2 + 10\text{HO}$ | 143.00           | $\text{NaO}$ 21.67 $\text{CO}_2$ 15.39 $\text{HO}$ 62.94 |
| “ Bi               | $\text{NaO}, 2\text{CO}_2 + \text{HO}$  | 84.00            | $\text{NaO}$ 36.90 $\text{CO}_2$ 52.38 $\text{HO}$ 10.72 |
| Strontium          | $\text{SrO}, \text{CO}_2$               | 73.75            | $\text{SrO}$ 70.15 $\text{CO}_2$ 29.85                   |
| Zinc               | $\text{ZnO}, \text{CO}_2$               | 62.50            | $\text{ZnO}$ 64.80 $\text{CO}_2$ 35.20                   |
| <b>Chlorates.</b>  |                                         |                  |                                                          |
| Barium             | $\text{BaO}, \text{ClO}_5$              | 152.00           | $\text{BaO}$ 50.33 $\text{ClO}_5$ 49.67                  |
| Potassium          | $\text{KO}, \text{ClO}_5$               | 122.50           | $\text{KO}$ 38.37 $\text{ClO}_5$ 61.63                   |
| Silver             | $\text{AgO}, \text{ClO}_5$              | 191.50           | $\text{AgO}$ 60.57 $\text{ClO}_5$ 39.43                  |
| Sodium             | $\text{NaO}, \text{ClO}_5$              | 106.50           | $\text{NaO}$ 29.11 $\text{ClO}_5$ 70.89                  |
| <b>Chromates.</b>  |                                         |                  |                                                          |
| Barium             | $\text{BaO}, \text{CrO}_3$              | 126.50           | $\text{BaO}$ 60.47 $\text{CrO}_3$ 39.53                  |
| Bismuth            | $\text{BiO}_3, 2\text{CrO}_3$           | 332.00           | $\text{BiO}_3$ 69.88 $\text{CrO}_3$ 30.12                |

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lead, Neutral<br>" Basic                                                                                                              | PbO, CrO <sub>3</sub><br>2PbO, CrO <sub>3</sub><br>4Hg <sub>2</sub> O, 3CrO <sub>3</sub><br>KO, CrO <sub>3</sub><br>KO, 2CrO <sub>3</sub><br>AgO, 2CrO <sub>3</sub>                                                                                                                                                                                       | 161.50<br>273.00<br>982.00<br>97.00<br>147.00<br>216.00                                                          | PbO 69.04 CrO <sub>3</sub> 30.96<br>PbO 81.69 CrO <sub>3</sub> 18.31<br>Hg <sub>2</sub> O 84.72 CrO <sub>3</sub> 15.28<br>KO 48.45 CrO <sub>3</sub> 51.55<br>KO 31.96 CrO <sub>3</sub> 68.04<br>AgO 53.70 CrO <sub>3</sub> 46.30                                                                                                                                                                                                                                        |
| Nitrates.                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Ammonium<br>Barium<br>Bismuth<br>Cobalt<br>Calcium<br>Lead<br>Magnesium<br>Mercury, Sub<br>Potassium<br>Silver<br>Sodium<br>Strontium | NH <sub>4</sub> O, NO <sub>5</sub><br>BaO, NO <sub>5</sub><br>BiO <sub>3</sub> , 3NO <sub>5</sub> + 10HO<br>CoO, NO <sub>5</sub> + 6HO<br>CaO, NO <sub>5</sub><br>PbO, NO <sub>5</sub><br>MgO, NO <sub>5</sub><br>Hg <sub>2</sub> O, NO <sub>5</sub> + 2HO<br>KO, NO <sub>5</sub><br>AgO, NO <sub>5</sub><br>NaO, NO <sub>5</sub><br>SrO, NO <sub>5</sub> | 80.00<br>130.50<br>484.00<br>146.00<br>82.00<br>165.50<br>74.00<br>280.00<br>101.00<br>170.00<br>85.00<br>105.75 | NH <sub>4</sub> O 32.50 NO <sub>5</sub> 67.50<br>BaO 58.62 NO <sub>5</sub> 41.38<br>BiO 47.94 NO <sub>5</sub> 33.47 HO 18.59<br>CoO 26.02 NO <sub>5</sub> 36.99 HO 36.99<br>CaO 34.15 NO <sub>5</sub> 65.85<br>PbO 67.37 NO <sub>5</sub> 32.63<br>MgO 27.03 NO <sub>5</sub> 72.97<br>HgO 74.29 NO <sub>5</sub> 19.28 HO 6.43<br>KO 46.54 NO <sub>5</sub> 53.46<br>AgO 68.23 NO <sub>5</sub> 31.77<br>NaO 36.47 NO <sub>5</sub> 63.53<br>SrO 48.93 NO <sub>5</sub> 51.07 |
| Oxalates.                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| $\bar{O} = C_2O_3 = 36.$                                                                                                              |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Calcium<br>Potassium<br>" Bin<br>" Per                                                                                                | CaO, $\bar{O}$ + HO<br>KO, $\bar{O}$ + HO<br>KO, 2 $\bar{O}$ + 3HO<br>KO, 4 $\bar{O}$ + 7HO                                                                                                                                                                                                                                                               | 73.00<br>92.00<br>146.00<br>254.00                                                                               | CaO 38.35 $\bar{O}$ 49.32 HO 12.33<br>KO 51.09 $\bar{O}$ 39.12 HO 9.79<br>KO 32.19 $\bar{O}$ 49.31 HO 18.50<br>KO 18.51 $\bar{O}$ 56.69 KO 24.80                                                                                                                                                                                                                                                                                                                        |

| Base.              | Formula.                                                                              | Equiva-<br>lent. | Per cent of Constituents.                                                                           |
|--------------------|---------------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------|
| <b>Phosphates.</b> |                                                                                       |                  |                                                                                                     |
| Ammonium           | $2\text{NH}_4\text{O}, \text{HO}, \text{PO}_5$                                        | 132.00           | $\text{NH}_4\text{O}$ 39.39 $\text{HO}$ 6.82 $\text{PO}_5$ 53.79                                    |
| " and Magnesium    | $\text{NH}_4\text{O}, 2\text{MgO}, \text{PO}_5 + 12\text{HO}$                         | 245.00           | $\{\text{NH}_4\text{O}$ 10.61 $\text{MgO}$ 16.33<br>$\text{PO}_5$ 28.98 $\text{HO}$ 44.08           |
| Calcium            | $3\text{CaO}, \text{PO}_5$                                                            | 155.00           | $\text{CaO}$ 54.19 $\text{PO}_5$ 45.81                                                              |
| Iron               | $\text{Fe}_2\text{O}_3, \text{PO}_5$                                                  | 151.00           | $\text{Fe}_2\text{O}_3$ 52.98 $\text{PO}_5$ 47.02                                                   |
| Magnesium, Pyro    | $2\text{MgO}, \text{PO}_5$                                                            | 111.00           | $\text{MgO}$ 36.04 $\text{PO}_5$ 63.96                                                              |
| Manganese, "       | $2\text{MnO}, \text{PO}_5$                                                            | 141.00           | $\text{MnO}$ 49.65 $\text{PO}_5$ 50.35                                                              |
| Sodium             | $2\text{NaO}, \text{HO}, \text{PO}_5 + 24\text{HO}$                                   | 358.00           | $\text{NaO}$ 17.32 $\text{PO}_5$ 19.83 $\text{HO}$ 62.85                                            |
| Silver             | $3\text{AgO}, \text{PO}_5$                                                            | 419.00           | $\text{AgO}$ 83.05 $\text{PO}_5$ 16.95                                                              |
| " Pyro             | $2\text{AgO}, \text{PO}_5$                                                            | 303.00           | $\text{AgO}$ 76.57 $\text{PO}_5$ 23.43                                                              |
| Uranium            | $\text{U}_2\text{O}_3, \text{PO}_5$                                                   | 359.00           | $\text{U}_2\text{O}_3$ 80.22 $\text{PO}_5$ 19.78                                                    |
| <b>Sulphates.</b>  |                                                                                       |                  |                                                                                                     |
| Aluminum           | $\text{Al}_2\text{O}_3, 3\text{SO}_3 + 18\text{HO}$                                   | 333.50           | $\text{Al}_2\text{O}_3$ 15.44 $\text{SO}_3$ 35.98 $\text{HO}$ 48.58                                 |
| Ammonium           | $\text{NH}_4\text{O}, \text{SO}_3$                                                    | 66.00            | $\text{NH}_4\text{O}$ 39.40 $\text{SO}_3$ 60.60                                                     |
| " and Aluminum     | $\text{NH}_4\text{O}, \text{SO}_3, \text{Al}_2\text{O}_3, 3\text{SO}_3 + 24\text{HO}$ | 453.50           | $\{\text{NH}_4\text{O}$ 5.73 $\text{Al}_2\text{O}_3$ 11.36<br>$\text{SO}_3$ 35.28 $\text{HO}$ 47.63 |
| Barium             | $\text{BaO}, \text{SO}_3$                                                             | 116.50           | $\text{BaO}$ 65.67 $\text{SO}_3$ 34.33                                                              |
| Calcium            | $\text{CaO}, \text{SO}_3$                                                             | 68.00            | $\text{CaO}$ 41.18 $\text{SO}_3$ 58.82                                                              |
| " Crystal.         | $\text{CaO}, \text{SO}_3 + 2\text{HO}$                                                | 86.00            | $\text{CaO}$ 32.56 $\text{SO}_3$ 46.51 $\text{HO}$ 20.93                                            |
| Cobalt             | $\text{CoO}, \text{SO}_3$                                                             | 78.00            | $\text{CoO}$ 48.72 $\text{SO}_3$ 51.28                                                              |
| " Crystal.         | $\text{CoO}, \text{SO}_3 + 7\text{HO}$                                                | 141.00           | $\text{CoO}$ 26.95 $\text{SO}_3$ 28.37 $\text{HO}$ 44.68                                            |
| Copper             | $\text{CuO}, \text{SO}_3$                                                             | 79.75            | $\text{CuO}$ 49.84 $\text{SO}_3$ 50.16                                                              |
| " Crystal.         | $\text{CuO}, \text{SO}_3 + 5\text{HO}$                                                | 124.75           | $\text{CuO}$ 31.86 $\text{SO}_3$ 32.07 $\text{HO}$ 36.07                                            |

|                                                                                                                       |                                                                                                                                                                                                                                                                                                 |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Iron<br>" Crystal.<br>Magnesium<br>" Crystal.<br>Manganese<br>Nickel, Crystal.<br>Potassium<br>" Bi<br>" and Aluminum | FeO, SO <sub>3</sub><br>FeO, SO <sub>3</sub> + 7HO<br>MgO, SO <sub>3</sub><br>MgO, SO <sub>3</sub> + 7HO<br>MnO, SO <sub>3</sub><br>NiO, SO <sub>3</sub> + 7HO<br>KO, SO <sub>3</sub><br>KO, 2SO <sub>3</sub><br>KO, SO <sub>3</sub> , Al <sub>2</sub> O <sub>3</sub> , 3SO <sub>3</sub> + 24HO | 76.00<br>139.00<br>60.00<br>123.00<br>75.00<br>140.00<br>87.00<br>127.00<br>474.50 | FeO 47.37 SO <sub>3</sub> 52.63<br>FeO 25.89 SO <sub>3</sub> 28.77 HO 45.34<br>MgO 33.33 SO <sub>3</sub> 66.67<br>MgO 16.26 SO <sub>3</sub> 32.52 HO 51.22<br>MnO 46.67 SO <sub>3</sub> 53.33<br>NiO 26.43 SO <sub>3</sub> 28.57 HO 45.00<br>KO 54.02 SO <sub>3</sub> 45.98<br>KO 37.00 SO <sub>3</sub> 63.00<br>{ KO 9.90 Al <sub>2</sub> O <sub>3</sub> 10.86<br>SO <sub>3</sub> 33.71 HO 45.52 |
| Lead<br>Sodium<br>" Crystal.<br>Silver<br>Strontium<br>Zinc<br>" Crystal.                                             | PbO, SO <sub>3</sub><br>NaO, SO <sub>3</sub><br>NaO, SO <sub>3</sub> + 10HO<br>AgO, SO <sub>3</sub><br>SrO, SO <sub>3</sub><br>ZnO, SO <sub>3</sub><br>ZnO, SO + 7HO                                                                                                                            | 151.50<br>71.00<br>161.00<br>156.00<br>91.75<br>80.50<br>143.50                    | PbO 73.60 SO <sub>3</sub> 26.40<br>NaO 43.66 SO <sub>3</sub> 56.34<br>NaO 19.25 SO <sub>3</sub> 24.85 HO 55.90<br>AgO 74.36 SO <sub>3</sub> 25.64<br>SrO 56.40 SO <sub>3</sub> 43.60<br>ZnO 50.31 SO <sub>3</sub> 49.69<br>ZnO 28.22 SO <sub>3</sub> 27.88 HO 43.90                                                                                                                               |
| Tartrates.                                                                                                            |                                                                                                                                                                                                                                                                                                 |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                   |
| $\bar{T} = C_8H_4O_{10} = 132.$                                                                                       |                                                                                                                                                                                                                                                                                                 |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                   |
| Calcium<br>Potassium<br>" Acid<br>" and Sodium<br>" Antimony                                                          | 2CaO, $\bar{T}$ + 8HO<br>2KO, $\bar{T}$ + HO<br>KO, HO, $\bar{T}$<br>KO, NaO, $\bar{T}$ + 8HO<br>KO, SbO <sub>3</sub> , $\bar{T}$ + HO                                                                                                                                                          | 260.00<br>235.00<br>188.00<br>282.00<br>332.00                                     | CaO 21.54 $\bar{T}$ 50.77 HO 27.69<br>KO 40.00 $\bar{T}$ 56.17 HO 3.83<br>KO 25.00 $\bar{T}$ 70.21 HO 4.79<br>{ KO 16.66 NaO 10.99.<br>$\bar{T}$ 46.81 HO 25.54<br>{ SbO <sub>3</sub> 43.37 KO 14.16<br>$\bar{T}$ 39.76 HO 2.71                                                                                                                                                                   |

## TABLE

OF FACTORS FOR THE REDUCTION OF THE SUBSTANCE FOUND  
IN ANALYSIS TO THE ONE SOUGHT.

*The weight found multiplied by the factor gives the weight of the substance  
sought.*

## FRESSENIUS'S ANALYSIS.

| Element. | Found.                                                       | Sought.               | Factor. |
|----------|--------------------------------------------------------------|-----------------------|---------|
| Aluminum | $\text{Al}_2\text{O}_3$                                      | $\text{Al}_2$         | 0.5340  |
| Ammonium | $\text{NH}_4\text{Cl}$                                       | $\text{NH}_3$         | 0.3178  |
|          | $\text{NH}_4\text{Cl}$                                       | $\text{NH}_4$         | 0.3365  |
|          | $\text{NH}_4\text{Cl}, \text{PtCl}_2$                        | $\text{NH}_3$         | 0.0760  |
|          | $\text{NH}_4\text{Cl}, \text{PtCl}_2$                        | $\text{NH}_4\text{O}$ | 0.1163  |
| Antimony | $\text{SbO}_3$                                               | $\text{Sb}$           | 0.8335  |
|          | $\text{SbS}_3$                                               | $\text{Sb}$           | 0.7143  |
|          | $\text{SbO}_4$                                               | $\text{Sb}$           | 0.7896  |
|          | $\text{SbO}_4$                                               | $\text{SbO}_3$        | 0.9474  |
| Arsenic  | $\text{AsO}_3$                                               | $\text{As}$           | 0.7576  |
|          | $\text{AsO}_5$                                               | $\text{As}$           | 0.6522  |
|          | $\text{AsO}_5$                                               | $\text{AsO}_3$        | 0.8609  |
|          | $\text{AsS}_3$                                               | $\text{As}$           | 0.6098  |
|          | $\text{AsS}_3$                                               | $\text{AsO}_3$        | 0.8049  |
|          | $\text{AsS}_3$                                               | $\text{AsO}_5$        | 0.9349  |
|          | $2\text{MgO}, \text{NH}_4\text{O}, \text{AsO}_5 + \text{HO}$ | $\text{AsO}_5$        | 0.6053  |
|          | $2\text{MgO}, \text{NH}_4\text{O}, \text{AsO}_5 + \text{HO}$ | $\text{AsO}_3$        | 0.5211  |
| Barium   | $\text{BaO}$                                                 | $\text{Ba}$           | 0.8955  |
|          | $\text{BaO}, \text{SO}_3$                                    | $\text{BaO}$          | 0.6567  |
|          | $\text{BaFl}, \text{SiFl}_2$                                 | $\text{BaO}$          | 0.5484  |
| Bismuth  | $\text{BiO}_3$                                               | $\text{Bi}$           | 0.8965  |
| Boron    | $\text{BO}_3$                                                | $\text{B}$            | 0.3143  |
| Bromine  | $\text{AgBr}$                                                | $\text{Br}$           | 0.4255  |
| Cadmium  | $\text{CdO}$                                                 | $\text{Cd}$           | 0.8750  |
| Cæsium   | $\text{CsCl}$                                                | $\text{Cs}$           | 0.7893  |
|          | $\text{CsO}, \text{SO}_3$                                    | $\text{CsO}$          | 0.7790  |
| Calcium  | $\text{CaO}$                                                 | $\text{Ca}$           | 0.7143  |
|          | $\text{CaO}, \text{SO}_3$                                    | $\text{CaO}$          | 0.4118  |
|          | $\text{CaO}, \text{CO}_2$                                    | $\text{CaO}$          | 0.5600  |
| Carbon   | $\text{CO}_2$                                                | $\text{C}$            | 0.2727  |
|          | $\text{CaO}, \text{CO}_2$                                    | $\text{CO}_2$         | 0.4400  |
| Cerium   | $\text{Ce}_3\text{O}_4$                                      | $\text{Ce}$           | 0.8118  |
| Chlorine | $\text{AgCl}$                                                | $\text{Cl}$           | 0.2474  |
|          | $\text{AgCl}$                                                | $\text{HCl}$          | 0.2537  |
| Chromium | $\text{Cr}_2\text{O}_3$                                      | $\text{Cr}$           | 0.6842  |



| Element.   | Found.                                | Sought.               | Factor. |
|------------|---------------------------------------|-----------------------|---------|
| Chromium   | $\text{Cr}_2\text{O}_3$               | $\text{CrO}_3$        | 0.6579  |
|            | $\text{PbO}, \text{CrO}_3$            | $\text{CrO}_3$        | 0.3096  |
| Cobalt     | $\text{Co}$                           | $\text{CoO}$          | 1.2667  |
|            | $\text{CoO}, \text{SO}_3$             | $\text{CoO}$          | 0.4872  |
| Copper     | $\text{CuO}$                          | $\text{Cu}$           | 0.7987  |
|            | $\text{Cu}_2\text{S}$                 | $\text{Cu}$           | 0.7987  |
| Didymium   | $\text{D}_2\text{O}$                  | $\text{D}$            | 0.8571  |
| Erbium     | $\text{ErO}$                          | $\text{Er}$           | 0.8756  |
| Fluorine   | $\text{CaF}$                          | $\text{F}$            | 0.4872  |
|            | $\text{SiF}_3$                        | $\text{F}$            | 0.7308  |
| Glucinum   | $\text{GO}$                           | $\text{G}$            | 0.3681  |
| Hydrogen   | $\text{HO}$                           | $\text{H}$            | 0.1111  |
| Indium     | $\text{InS}$                          | $\text{In}$           | 0.6981  |
| Iodine     | $\text{AgI}$                          | $\text{I}$            | 0.5404  |
|            | $\text{PdI}$                          | $\text{I}$            | 0.7042  |
| Iron       | $\text{Fe}_2\text{O}_3$               | $\text{Fe}$           | 0.7000  |
|            | $\text{Fe}_3\text{O}_3$               | $\text{FeO}$          | 0.9000  |
| Lanthanum  | $\text{LaO}$                          | $\text{La}$           | 0.8545  |
| Lead       | $\text{PbO}$                          | $\text{Pb}$           | 0.9283  |
|            | $\text{PbO}, \text{SO}_3$             | $\text{Pb}$           | 0.6832  |
|            | $\text{PbCl}$                         | $\text{Pb}$           | 0.7446  |
|            | $\text{PbS}$                          | $\text{Pb}$           | 0.8661  |
| Lithium    | $3\text{LO}, \text{PO}_5$             | $\text{LO}$           | 0.3879  |
|            | $\text{LCl}$                          | $\text{L}$            | 0.1647  |
| Magnesium  | $\text{MgO}$                          | $\text{Mg}$           | 0.6000  |
|            | $\text{MgO}, \text{SO}_3$             | $\text{MgO}$          | 0.3333  |
|            | $2\text{MgO}, \text{PO}_5$            | $\text{MgO}$          | 0.3604  |
| Manganese  | $\text{MnO}$                          | $\text{Mn}$           | 0.7714  |
|            | $\text{Mn}_2\text{O}_3$               | $\text{MnO}$          | 0.8973  |
|            | $\text{Mn}_3\text{O}_4$               | $\text{MnO}$          | 0.9292  |
|            | $\text{MnO}, \text{SO}_3$             | $\text{MnO}$          | 0.4667  |
|            | $2\text{MnO}, \text{PO}_5$            | $\text{MnO}$          | 0.4965  |
| Mercury    | $\text{Hg}$                           | $\text{Hg}_2\text{O}$ | 1.0400  |
|            | $\text{Hg}$                           | $\text{HgO}$          | 1.0800  |
|            | $\text{Hg}_2\text{Cl}$                | $\text{Hg}$           | 0.8492  |
|            | $\text{HgS}$                          | $\text{Hg}$           | 0.8621  |
| Molybdenum | $\text{MoO}_3$                        | $\text{Mo}$           | 0.6571  |
| Nickel     | $\text{NiO}$                          | $\text{Ni}$           | 0.7838  |
| Niobium    | $\text{NbO}_5$                        | $\text{Nb}$           | 0.7015  |
| Nitrogen   | $\text{NH}_4\text{Cl}, \text{PtCl}_2$ | $\text{N}$            | 0.0627  |
|            | $\text{Pt}$                           | $\text{N}$            | 0.1414  |
|            | $\text{AgC}_2\text{N}$                | $\text{C}_2\text{N}$  | 0.1941  |
|            | $\text{AgC}_2\text{N}$                | $\text{HC}_2\text{N}$ | 0.2015  |
| Oxygen     | $\text{Al}_2\text{O}_3$               | $\text{O}$            | 0.4660  |
|            | $\text{SbO}_3$                        | $\text{O}$            | 0.1665  |
|            | $\text{AsO}_3$                        | $\text{O}$            | 0.2424  |
|            | $\text{AsO}_5$                        | $\text{O}$            | 0.3478  |

| Element.  | Found.                         | Sought. | Factor. |
|-----------|--------------------------------|---------|---------|
| Oxygen    | BaO                            | O       | 0.1045  |
|           | BiO <sub>3</sub>               | O       | 0.1035  |
|           | CdO                            | O       | 0.1250  |
|           | CaO                            | O       | 0.2857  |
|           | Cr <sub>2</sub> O <sub>3</sub> | O       | 0.3158  |
|           | CuO                            | O       | 0.2012  |
|           | HO                             | O       | 0.8889  |
|           | Fe <sub>2</sub> O <sub>3</sub> | O       | 0.3000  |
|           | FeO                            | O       | 0.2222  |
|           | PbO                            | O       | 0.0717  |
|           | MgO                            | O       | 0.4000  |
|           | MnO                            | O       | 0.2286  |
|           | Mn <sub>3</sub> O <sub>4</sub> | O       | 0.2832  |
|           | Mn <sub>2</sub> O <sub>3</sub> | O       | 0.3077  |
|           | MnO <sub>2</sub>               | O       | 0.3721  |
|           | MnO <sub>3</sub>               | O       | 0.4706  |
|           | Mn <sub>2</sub> O <sub>7</sub> | O       | 0.5091  |
|           | HgO                            | O       | 0.0741  |
|           | Hg <sub>2</sub> O              | O       | 0.0385  |
|           | KO                             | O       | 0.1706  |
|           | SiO <sub>3</sub>               | O       | 0.5333  |
|           | AgO                            | O       | 0.0690  |
|           | NaO                            | O       | 0.2581  |
|           | SrO                            | O       | 0.1546  |
|           | SnO                            | O       | 0.2162  |
|           | ZnO                            | O       | 0.1976  |
| Potassium | KO                             | K       | 0.8294  |
|           | KO, SO <sub>3</sub>            | KO      | 0.5402  |
|           | KO, NO <sub>5</sub>            | KO      | 0.4654  |
|           | KCl                            | KO      | 0.6309  |
|           | KCl                            | K       | 0.6235  |
|           | KCl, PtCl <sub>2</sub>         | KO      | 0.1922  |
|           | KCl, PtCl <sub>2</sub>         | KCl     | 0.3047  |
| Rubidium  | RbCl                           | RbO     | 0.7725  |
|           | RbO                            | Rb      | 0.9143  |
| Silicon   | SiO <sub>2</sub>               | Si      | 0.4667  |
| Silver    | AgCl                           | Ag      | 0.7526  |
|           | AgCl                           | AgO     | 0.8084  |
| Sodium    | NaO                            | Na      | 0.7419  |
|           | NaO, SO <sub>3</sub>           | NaO     | 0.4366  |
|           | NaO, NO <sub>5</sub>           | NaO     | 0.3647  |
|           | NaCl                           | NaO     | 0.5299  |
|           | NaCl                           | Na      | 0.3922  |
|           | NaO, CO <sub>2</sub>           | NaO     | 0.5849  |
| Strontium | SrO                            | Sr      | 0.8454  |
|           | SrO, SO <sub>3</sub>           | SrO     | 0.5640  |
|           | SrO, CO <sub>2</sub>           | SrO     | 0.7015  |



| Element.  | Found.               | Sought.         | Factor. |
|-----------|----------------------|-----------------|---------|
| Sulphur   | BaO, SO <sub>3</sub> | S               | 0.1372  |
|           | BaO, SO <sub>3</sub> | SO <sub>3</sub> | 0.3433  |
|           | AsS <sub>3</sub>     | S               | 0.3902  |
| Tantalum  | TaO <sub>5</sub>     | Ta              | 0.8113  |
| Thallium  | TlS                  | Tl              | 0.9272  |
| "         | TlI                  | Tl              | 0.6163  |
| Thorium   | ThO <sub>2</sub>     | Th              | 0.8788  |
| Tin       | SnO <sub>2</sub>     | Sn              | 0.7838  |
|           | SnO <sub>2</sub>     | SnO             | 0.8919  |
| Titanium  | TiO <sub>2</sub>     | Ti              | 0.6098  |
| Tungsten  | WO <sub>3</sub>      | W               | 0.7143  |
| Yttrium   | YO                   | Y               | 0.7941  |
| Zinc      | ZnO                  | Zn              | 0.8024  |
| Zirconium | ZrO <sub>2</sub>     | Zr              | 0.8485  |

### FORMULAS FOR INDIRECT ESTIMATION.

#### 1. Estimation of Sulphates of Potassium and Sodium.

$$\begin{aligned}
 N &= 9.65158 A - 4.43751 S & S &= \text{weight of both Sulphates} \\
 & & K &= \text{weight of KO, SO}_3 \\
 K &= S - N & N &= \text{weight of NaO, SO}_3 \\
 & & A &= \text{weight of SO}_3.
 \end{aligned}$$

#### 2. Estimation of Potassium and Sodium from the Chlorides.

$$\begin{aligned}
 K &= 2.4375 S - 4.01672 A & S &= \text{weight of both Chlorides} \\
 N &= S - (A + K) & A &= \text{weight of Chlorine} \\
 & & N &= \text{weight of Sodium} \\
 & & K &= \text{weight of Potassium.}
 \end{aligned}$$

#### 3. Carbonates of Lime and Strontia.

$$\begin{aligned}
 Ca &= 7.0574 A - 2.10526 S & S &= \text{weight of both Carbonates} \\
 Sr &= S - Ca & A &= \text{weight of Carbonic Acid} \\
 & & Ca &= \text{weight of Carbonate of Lime} \\
 & & Sr &= \text{weight of Carbonate of Strontia.}
 \end{aligned}$$

## TABLE OF FACTORS.

FOR SODA, POTASSA, AND BINOXIDE OF MANGANESE.

*The weight of the substance found multiplied by the factor gives the weight of the substance sought.*

| Found.            | Sought.                     | Factor. |
|-------------------|-----------------------------|---------|
| <b>Soda.</b>      |                             |         |
| CO <sub>2</sub>   | NaO                         | 1.4091  |
| "                 | NaO, HO                     | 1.8182  |
| "                 | NaO, CO <sub>2</sub>        | 2.4091  |
| "                 | NaO, CO <sub>2</sub> + 10HO | 6.5000  |
| NaO               | NaO, HO                     | 1.2903  |
| "                 | NaO, CO <sub>2</sub>        | 1.7097  |
| "                 | NaO, CO <sub>2</sub> + 10HO | 4.6129  |
| <b>Potassa.</b>   |                             |         |
| CO <sub>2</sub>   | KO                          | 2.1363  |
| "                 | KO, HO                      | 2.5450  |
| "                 | KO, CO <sub>2</sub>         | 3.1363  |
| KO                | KO, HO                      | 1.1915  |
| "                 | KO, CO <sub>2</sub>         | 1.4681  |
| <b>Manganese.</b> |                             |         |
| CO <sub>2</sub>   | MnO <sub>2</sub>            | 0.9773  |

TABLE

*Giving the corresponding per cents of Chlorine and Binoxide of Manganese, from the amount of Sulphate of Iron Peroxidized, when 5 grammes of Black Oxide of Manganese and 31.9 grammes of Sulphate of Iron are taken for testing.*

OTTO'S LEHRBUCH.

| Decigrammes remaining of Sulphate of Iron. | Decigrammes used of Sulphate of Iron. | Per cent of Binoxide contained in the Manganese. | Per cent of Chlorine liberated by the Manganese. | Decigrammes remaining of Sulphate of Iron. | Decigrammes used of Sulphate of Iron. | Per cent of Binoxide contained in the Manganese. | Per cent of Chlorine liberated by the Manganese. |
|--------------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------|---------------------------------------|--------------------------------------------------|--------------------------------------------------|
| 0                                          | 319                                   | 100                                              | 81.3                                             | 98                                         | 221                                   | 69                                               | 56.3                                             |
| 3                                          | 316                                   | 99                                               | 80.6                                             | 102                                        | 217                                   | 68                                               | 55.3                                             |
| 6                                          | 313                                   | 98                                               | 79.8                                             | 105                                        | 214                                   | 67                                               | 54.5                                             |
| 9                                          | 310                                   | 97                                               | 79.0                                             | 108                                        | 211                                   | 66                                               | 53.8                                             |
| 12                                         | 307                                   | 96                                               | 78.2                                             | 111                                        | 208                                   | 65                                               | 53.0                                             |
| 15                                         | 304                                   | 95                                               | 77.4                                             | 115                                        | 204                                   | 64                                               | 52.0                                             |
| 18                                         | 301                                   | 94                                               | 76.5                                             | 118                                        | 201                                   | 63                                               | 51.2                                             |
| 22                                         | 297                                   | 63                                               | 75.7                                             | 121                                        | 198                                   | 62                                               | 50.5                                             |
| 25                                         | 294                                   | 92                                               | 75.0                                             | 124                                        | 195                                   | 61                                               | 49.7                                             |
| 28                                         | 291                                   | 91                                               | 74.3                                             | 127                                        | 192                                   | 60                                               | 48.9                                             |
| 31                                         | 288                                   | 90                                               | 73.5                                             | 130                                        | 189                                   | 59                                               | 48.2                                             |
| 34                                         | 285                                   | 89                                               | 72.7                                             | 134                                        | 185                                   | 58                                               | 47.2                                             |
| 38                                         | 281                                   | 88                                               | 71.6                                             | 137                                        | 182                                   | 57                                               | 46.4                                             |
| 41                                         | 278                                   | 87                                               | 70.9                                             | 140                                        | 179                                   | 56                                               | 45.6                                             |
| 44                                         | 275                                   | 86                                               | 70.1                                             | 143                                        | 176                                   | 55                                               | 44.9                                             |
| 47                                         | 272                                   | 85                                               | 69.3                                             | 147                                        | 172                                   | 54                                               | 43.8                                             |
| 50                                         | 269                                   | 84                                               | 68.6                                             | 150                                        | 169                                   | 53                                               | 43.1                                             |
| 53                                         | 266                                   | 83                                               | 67.8                                             | 153                                        | 166                                   | 52                                               | 42.3                                             |
| 57                                         | 262                                   | 82                                               | 66.8                                             | 156                                        | 163                                   | 51                                               | 41.5                                             |
| 60                                         | 259                                   | 81                                               | 66.0                                             | 159                                        | 160                                   | 50                                               | 40.8                                             |
| 63                                         | 256                                   | 80                                               | 65.3                                             | 162                                        | 157                                   | 49                                               | 40.0                                             |
| 66                                         | 253                                   | 79                                               | 64.5                                             | 165                                        | 154                                   | 48                                               | 39.3                                             |
| 69                                         | 250                                   | 78                                               | 63.7                                             | 168                                        | 151                                   | 47                                               | 38.5                                             |
| 73                                         | 246                                   | 77                                               | 62.7                                             | 172                                        | 147                                   | 46                                               | 37.5                                             |
| 76                                         | 243                                   | 76                                               | 61.9                                             | 175                                        | 144                                   | 45                                               | 36.7                                             |
| 79                                         | 240                                   | 75                                               | 61.2                                             | 178                                        | 141                                   | 44                                               | 35.9                                             |
| 82                                         | 237                                   | 74                                               | 60.4                                             | 182                                        | 137                                   | 43                                               | 34.9                                             |
| 85                                         | 234                                   | 73                                               | 59.6                                             | 185                                        | 134                                   | 42                                               | 34.2                                             |
| 89                                         | 230                                   | 72                                               | 58.6                                             | 188                                        | 131                                   | 41                                               | 33.4                                             |
| 92                                         | 227                                   | 71                                               | 57.8                                             | 191                                        | 128                                   | 40                                               | 32.6                                             |
| 95                                         | 224                                   | 70                                               | 57.1                                             |                                            |                                       |                                                  |                                                  |

TABLE

*Giving the per cent of Chlorine in Chloride of Lime from the number of parts it takes to Peroxidize 3.9 grammes of Sulphate of Iron, when 100 parts of the Solution contain 5 grammes of the Chloride of Lime to be tested.*

(OTTO'S LEHRBUCH.)

| Number of<br>Parts used of<br>the Solution of<br>Chloride of<br>Lime. | Per cent<br>of Chlorine. | Number of<br>Parts used of<br>the Solution of<br>Chloride of<br>Lime. | Per cent<br>of Chlorine. | Number of<br>Parts used of<br>the Solution of<br>Chloride of<br>Lime. | Per cent<br>of Chlorine. |
|-----------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------|--------------------------|
| 31                                                                    | 32.2                     | 55                                                                    | 18.2                     | 79                                                                    | 12.7                     |
| 32                                                                    | 31.2                     | 56                                                                    | 17.8                     | 80                                                                    | 12.5                     |
| 33                                                                    | 30.3                     | 57                                                                    | 17.5                     | 81                                                                    | 12.3                     |
| 34                                                                    | 29.4                     | 58                                                                    | 17.2                     | 82                                                                    | 12.2                     |
| 35                                                                    | 28.6                     | 59                                                                    | 17.0                     | 83                                                                    | 12.0                     |
| 36                                                                    | 27.8                     | 60                                                                    | 16.7                     | 84                                                                    | 11.9                     |
| 37                                                                    | 27.0                     | 61                                                                    | 16.4                     | 85                                                                    | 11.7                     |
| 38                                                                    | 26.3                     | 62                                                                    | 16.1                     | 86                                                                    | 11.6                     |
| 39                                                                    | 25.6                     | 63                                                                    | 15.9                     | 87                                                                    | 11.5                     |
| 40                                                                    | 25.0                     | 64                                                                    | 15.6                     | 88                                                                    | 11.3                     |
| 41                                                                    | 24.4                     | 65                                                                    | 15.4                     | 89                                                                    | 11.2                     |
| 42                                                                    | 23.8                     | 66                                                                    | 15.1                     | 90                                                                    | 11.1                     |
| 43                                                                    | 23.3                     | 67                                                                    | 14.9                     | 91                                                                    | 10.9                     |
| 44                                                                    | 22.7                     | 68                                                                    | 14.7                     | 92                                                                    | 10.8                     |
| 45                                                                    | 22.2                     | 69                                                                    | 14.5                     | 93                                                                    | 10.7                     |
| 46                                                                    | 21.7                     | 70                                                                    | 14.3                     | 94                                                                    | 10.6                     |
| 47                                                                    | 21.3                     | 71                                                                    | 14.1                     | 95                                                                    | 10.5                     |
| 48                                                                    | 20.8                     | 72                                                                    | 13.9                     | 96                                                                    | 10.4                     |
| 49                                                                    | 20.4                     | 73                                                                    | 13.7                     | 97                                                                    | 10.3                     |
| 50                                                                    | 20.0                     | 74                                                                    | 13.5                     | 98                                                                    | 10.2                     |
| 51                                                                    | 19.6                     | 75                                                                    | 13.3                     | 99                                                                    | 10.1                     |
| 52                                                                    | 19.2                     | 76                                                                    | 13.1                     | 100                                                                   | 10.0                     |
| 53                                                                    | 18.8                     | 77                                                                    | 13.0                     |                                                                       |                          |
| 54                                                                    | 18.5                     | 78                                                                    | 12.8                     |                                                                       |                          |

**T A B L E S**

**RELATING TO**

**SPECIFIC GRAVITY.**



## SPECIFIC GRAVITIES OF THE ELEMENTS.

| Element.                          | Specific Gravity. | Element.                        | Specific Gravity. |
|-----------------------------------|-------------------|---------------------------------|-------------------|
| <b>Solids and Liquids.</b>        |                   |                                 |                   |
| Water = 1 at 0° C., 760 m. Barom. |                   |                                 |                   |
| Aluminum                          | 2.670             | Palladium                       | 11-12             |
| Antimony                          | 6.720             | Phosphorus { Amorphous          | 2.089             |
| Arsenic                           | 5.630             | { Crystallized                  | 1.826             |
| Barium                            | 1.850             | Platinum                        | 20.8-21.74        |
| Bismuth                           | 9.780             | Potassium                       | 0.865             |
| Boron                             | 2.680             | Rhodium                         | 11.000            |
| Bromine                           | 3.187             | Rubidium                        | 1.520             |
| Cadmium                           | 8.604             | Ruthenium                       | 11-12             |
| Calcium                           | 1.578             | Selenium { Amorphous            | 4.250             |
| Carbon { Diamond                  | 3.500             | { Crystallized                  | 4.800             |
|                                   | 2.200             | Silicon                         | 2.490             |
|                                   | 2.000             | Silver                          | 10.570            |
| Chromium                          | 6.810             | Sodium                          | 0.972             |
| Cobalt                            | 8.950             | Strontium                       | 2.540             |
| Copper                            | 8.8-9             | Sulphur { Rhombic               | 2.070             |
| Glucinum                          | 2.100             |                                 | 1.958             |
| Gold                              | 19.340            |                                 | 1.919             |
| Indium                            | 7.200             | Tantalum                        | 10.780            |
| Iodine                            | 4.950             | Tellurium                       | 6.650             |
| Iridium                           | 21.800            | Thallium                        | 11.862            |
| Iron                              | 7.840             | Tin                             | 7.300             |
| Lead                              | 11.330            | Tungsten                        | 17.500            |
| Lithium                           | 0.593             | Uranium                         | 18.400            |
| Magnesium                         | 1.750             | Vanadium                        | 3.640             |
| Manganese                         | 8.000             | Zinc                            | 7.200             |
| Mercury                           | 13.596            | <b>Gases.</b>                   |                   |
| Molybdenum                        | 8.640             | Air = 1 at 0° C., 760 m. Barom. |                   |
| Nickel                            | 8.900             | Chlorine                        | 2.47000           |
| Osmium                            | 21.400            | Hydrogen                        | 0.06926           |
|                                   |                   | Nitrogen                        | 0.97137           |
|                                   |                   | Oxygen                          | 1.10563           |



## TABLE

OF THE SPECIFIC GRAVITIES OF THE MOST FREQUENTLY OCCURRING COMBINATIONS.

BOEDEKER. — Supplement zu den Lehrbüchern der Chemie und Mineralogie.

| Name.                        | Formula.                   | Specific Gravity. |
|------------------------------|----------------------------|-------------------|
| <b>Bromides.</b>             |                            |                   |
| Ammonium, Bromide            | $\text{NH}_4\text{Br}$     | 2.266             |
| Barium           “           | $\text{BaBr}$              | 4.230             |
| “           “       Crystal. | $\text{BaBr} + 2\text{HO}$ | 3.690             |
| Mercury       “              | $\text{HgBr}$              | 5.920             |
| “           “       Sub      | $\text{Hg}_2\text{Br}$     | 7.307             |
| Potassium     “              | $\text{KBr}$               | 2.415             |
| Silver         “             | $\text{AgBr}$              | 6.273             |
| Sodium        “              | $\text{NaBr}$              | 3.079             |
| <b>Chlorides.</b>            |                            |                   |
| Ammonium, Chloride           | $\text{NH}_4\text{Cl}$     | 1.500             |
| Barium         “             | $\text{BaCl}$              | 3.800             |
| “           “       Crystal. | $\text{BaCl} + 2\text{HO}$ | 3.050             |
| Calcium        “             | $\text{CaCl}$              | 2.205             |
| “           “       Crystal. | $\text{CaCl} + 6\text{HO}$ | 1.612             |
| Copper         “             | $\text{Cu}_2\text{Cl}$     | 3.680             |
| Iron            “            | $\text{FeCl}$              | 2.528             |
| Lead            “            | $\text{PbCl}$              | 5.540             |
| Lithium        “             | $\text{LiCl}$              | 1.998             |
| Manganese     “              | $\text{MnCl} + 4\text{HO}$ | 2.0146            |
| Mercury        “             | $\text{HgCl}$              | 5.420             |
| “           “       Sub      | $\text{Hg}_2\text{Cl}$     | 6.990             |
| Nickel         “             | $\text{NiCl}$              | 2.560             |
| Potassium     “              | $\text{KCl}$               | 1.950             |
| Silver         “             | $\text{AgCl}$              | 5.500             |
| Sodium        “              | $\text{NaCl}$              | 2.160             |
| Strontium     “              | $\text{SrCl}$              | 2.960             |
| Tin            “             | $\text{SnCl} + 2\text{HO}$ | 2.293             |
| <b>Iodides.</b>              |                            |                   |
| Barium, Iodide               | $\text{BaI}$               | 4.917             |
| Copper         “             | $\text{CuI}$               | 4.410             |
| Lead            “            | $\text{PbI}$               | 6.384             |

| Name.                  | Formula.                            | Specific Gravity. |
|------------------------|-------------------------------------|-------------------|
| Mercury, Iodide        | HgI                                 | 6.257             |
| “ “ Sub                | Hg <sub>2</sub> I                   | 7.750             |
| Potassium “            | KI                                  | 3.056             |
| Silver “               | AgI                                 | 5.614             |
| Sodium “               | NaI                                 | 3.450             |
| <b>Oxides.</b>         |                                     |                   |
| Aluminum, Oxide        | Al <sub>2</sub> O <sub>3</sub>      | 4.000             |
| Antimonic Acid         | SbO <sub>5</sub>                    | 6.525             |
| Antimonous Acid        | SbO <sub>4</sub>                    | 6.695             |
| Antimony, Oxide        | SbO <sub>3</sub>                    | 5.566             |
| Arsenous Acid          | AsO <sub>3</sub>                    | 3.884             |
| Arsenic “              | AsO <sub>5</sub>                    | 3.734             |
| Barium, Oxide          | BaO                                 | 5.456–4.732       |
| “ “ Crystal.           | BaO + 9HO                           | 1.656             |
| “ Hydrate              | BaO, HO                             | 4.495             |
| Boric Acid             | BO <sub>3</sub>                     | 1.830             |
| “ “ Crystal.           | BO <sub>3</sub> + 3HO               | 1.479             |
| Bismuth, Oxide         | BiO <sub>3</sub>                    | 8.968             |
| Cadmium “              | CdO                                 | 8.110             |
| Calcium “              | CaO                                 | 3.180             |
| Chromium “             | Cr <sub>2</sub> O <sub>3</sub>      | 5.210             |
| Cobalt “               | Co <sub>2</sub> O <sub>3</sub>      | 5.600             |
| Copper “               | CuO                                 | 6.430             |
| “ “ Sub                | Cu <sub>2</sub> O                   | 5.751             |
| Iron, Protosesquioxide | Fe <sub>3</sub> O <sub>4</sub>      | 5.185             |
| “ Sesquioxide          | Fe <sub>2</sub> O <sub>3</sub>      | 5.224             |
| “ Hydrate              | Fe <sub>2</sub> O <sub>3</sub> , HO | 3.7–3.9           |
| Lead, Oxide            | PbO                                 | 9.360             |
| “ “ Per                | PbO <sub>2</sub>                    | 9.300             |
| Magnesium, Oxide       | MgO                                 | 3.200             |
| Manganese “            | MnO                                 | 4.720             |
| “ “ Sesqui             | Mn <sub>2</sub> O <sub>3</sub>      | 4.820             |
| “ “ Per                | MnO <sub>2</sub>                    | 4.900             |
| “ “ Hydrate            | Mn <sub>2</sub> O <sub>3</sub> , HO | 4.328             |
| Mercury, Oxide         | HgO                                 | 11.290            |
| “ “ Sub                | Hg <sub>2</sub> O                   | 8.950             |
| Molybdenum, Oxide      | MoO <sub>2</sub>                    | 5.606             |
| “ Acid                 | MoO <sub>3</sub>                    | 3.460             |
| Nickel, Oxide          | NiO                                 | 6.660             |
| “ “ Sesqui             | Ni <sub>2</sub> O <sub>3</sub>      | 4.840             |
| Potassium, Oxide       | KO                                  | 2.656             |
| “ Hydrate              | KO, HO                              | 2.100             |
| Silicic Acid           | SiO <sub>2</sub>                    | 2.660             |
| Sodium, Oxide          | NaO                                 | 2.805             |
| “ Hydrate              | NaO, HO                             | 2.000             |

| Name.                   | Formula.                   | Specific Gravity. |
|-------------------------|----------------------------|-------------------|
| Strontium, Oxide        | $\text{SrO}$               | 4.611             |
| “ “ Crystal.            | $\text{SrO} + 9\text{HO}$  | 1.396             |
| Sulphuric Acid          | $\text{SO}_3$              | 1.970 (20°)       |
| Tin, Oxide              | $\text{SnO}$               | 6.666             |
| “ “ Bin                 | $\text{SnO}_2$             | 6.720–6.950       |
| Titanic Acid            | Anatase<br>$\text{TiO}_2$  | 3.840             |
|                         | Brookite<br>$\text{TiO}_2$ | 4.130             |
|                         | Rutile<br>$\text{TiO}_2$   | 4.250             |
| Tungstic Acid           | $\text{WO}_3$              | 7.1369            |
| Uranium, Oxide          | $\text{UO}$                | 10.150            |
| Uranium Protosquoioxide | $\text{U}_3\text{O}_4$     | 7.310             |
| Vanadic Acid            | $\text{VO}_3$              | 3.510             |
| Zinc, Oxide             | $\text{ZnO}$               | 5.630             |

## Sulphides.

|                       |                         |          |
|-----------------------|-------------------------|----------|
| Antimony, Tersulphide | $\text{SbS}_3$          | 4.752    |
| Arsenic “             | $\text{AsS}_3$          | 3.480    |
| “ Bisulphide          | $\text{AsS}_2$          | 3.544    |
| Bismuth, Sulphide     | $\text{BiS}_3$          | 7.000    |
| Cadmium “             | $\text{CdS}$            | 4.900    |
| Cobalt “              | $\text{Co}_2\text{S}_3$ | 4.800    |
| Copper “              | $\text{CuS}$            | 4.163    |
| “ “ Sub               | $\text{Cu}_2\text{S}$   | 5.500    |
| Iron “ Bi             | $\text{FeS}_2$          | 4.65–5.1 |
| “ “                   | $\text{FeS}$            | 4.400    |
| Lead “                | $\text{PbS}$            | 6.924    |
| Manganese “           | $\text{MnS}$            | 4.000    |
| “ “ Bi                | $\text{MnS}_2$          | 3.463    |
| Mercury “             | $\text{HgS}$            | 8.124    |
| Molybdenum “          | $\text{MoS}_2$          | 4.690    |
| Nickel “              | $\text{NiS}$            | 5.650    |
| Potassium “           | $\text{KS}$             | 2.130    |
| Silver “              | $\text{AgS}$            | 6.850    |
| Sodium “              | $\text{NaS}$            | 2.471    |
| Tin “                 | $\text{SnS}$            | 4.973    |
| “ “ Bi                | $\text{SnS}_2$          | 4.600    |
| Zinc “                | $\text{ZnS}$            | 3.920    |

## Borates.

|             |                                          |       |
|-------------|------------------------------------------|-------|
| Borax       | $\text{NaO}, 2\text{BO}_3 + 10\text{HO}$ | 1.740 |
| “ Anhydrous | $\text{NaO}, 2\text{BO}_3$               | 2.600 |

| Name.                  | Formula.                                             | Specific Gravity. |
|------------------------|------------------------------------------------------|-------------------|
| <b>Carbonates.</b>     |                                                      |                   |
| Ammonium, Carbonate    | $2\text{NH}_4\text{O}, 3\text{CO}_2$                 | 1.450             |
| Barium "               | $\text{BaO}, \text{CO}_2$                            | 4.300             |
| Calcium " Arragonite   | $\text{CaO}, \text{CO}_2$                            | 2.900             |
| " " Calc-spar          | $\text{CaO}, \text{CO}_2$                            | 2.720             |
| Iron "                 | $\text{FeO}, \text{CO}_2$                            | 3.870             |
| Lead "                 | $\text{PbO}, \text{CO}_2$                            | 6.400             |
| Lithium "              | $\text{LO}, \text{CO}_2$                             | 2.110             |
| Magnesium "            | $\text{MgO}, \text{CO}_2$                            | 2.990             |
| Manganese "            | $\text{MnO}, \text{CO}_2$                            | 3.55-3.95         |
| Potassium "            | $\text{KO}, \text{CO}_2$                             | 2.267             |
| Sodium "               | $\text{NaO}, \text{CO}_2$                            | 2.509             |
| " " Crystal.           | $\text{NaO}, \text{CO}_2 + 10\text{HO}$              | 1.454             |
| Strontium "            | $\text{SrO}, \text{CO}_2$                            | 3.600             |
| Zinc "                 | $\text{ZnO}, \text{CO}_2$                            | 4.1-4.5           |
| <b>Chlorates.</b>      |                                                      |                   |
| Barium, Chlorate       | $\text{BaO}, \text{ClO}_5$                           | 2.988             |
| Potassium "            | $\text{KO}, \text{ClO}_5$                            | 2.350             |
| Sodium "               | $\text{NaO}, \text{ClO}_5$                           | 2.289             |
| Silver "               | $\text{AgO}, \text{ClO}_5$                           | 4.430             |
| <b>Chromates.</b>      |                                                      |                   |
| Ammonium, Chromate, Bi | $\text{NH}_4\text{O}, 2\text{CrO}_3$                 | 2.367             |
| Lead "                 | $\text{PbO}, \text{CrO}_3$                           | 6.100             |
| Potassium "            | $\text{KO}, \text{CrO}_3$                            | 2.640             |
| " " Bi                 | $\text{KO}, 2\text{CrO}_3$                           | 2.603             |
| <b>Nitrates.</b>       |                                                      |                   |
| Ammonium, Nitrate      | $\text{NH}_4\text{O}, \text{NO}_5$                   | 1.740             |
| Barium "               | $\text{BaO}, \text{NO}_5$                            | 3.200             |
| Calcium "              | $\text{CaO}, \text{NO}_5$                            | 2.240             |
| Lead "                 | $\text{PbO}, \text{NO}_5$                            | 4.470             |
| Lithium "              | $\text{LO}, \text{NO}_5$                             | 2.334             |
| Potassium "            | $\text{KO}, \text{NO}_5$                             | 2.058             |
| Silver "               | $\text{AgO}, \text{NO}_5$                            | 4.355             |
| Strontium "            | $\text{SrO}, \text{NO}_5$                            | 2.810             |
| Sodium "               | $\text{NaO}, \text{NO}_5$                            | 2.200             |
| <b>Oxalates.</b>       |                                                      |                   |
| Ammonium, Oxalate      | $\text{NH}_4\text{O}, \bar{\text{O}} + 2\text{HO}$   | 1.500             |
| Potassium "            | $\text{KO}, \bar{\text{O}} + \text{HO}$              | 2.120             |
| " " Acid               | $\text{KO}, \text{HO}, 2\bar{\text{O}} + 2\text{HO}$ | 2.044             |

| Name.               | Formula.                                                                     | Specific Gravity. |
|---------------------|------------------------------------------------------------------------------|-------------------|
| <b>Phosphates.</b>  |                                                                              |                   |
| Lead, Phosphate     | $3\text{PbO}, \text{PO}_5$                                                   | 7.208             |
| Sodium “            | $2\text{NaO}, \text{HO}, \text{PO}_5 + 24\text{HO}$                          | 1.525             |
| “ “ Pyro            | $2\text{NaO}, \text{PO}_5 + 10\text{HO}$                                     | 1.836             |
| Silver “            | $3\text{AgO}, \text{PO}_5$                                                   | 5.306             |
| “ “ Pyro            | $2\text{AgO}, \text{PO}_5$                                                   | 7.300             |
| <b>Sulphates.</b>   |                                                                              |                   |
| Ammonium, Sulphate  | $\text{NH}_4\text{O}, \text{SO}_3$                                           | 1.760             |
| Barium “            | $\text{BaO}, \text{SO}_3$                                                    | 4.500             |
| Calcium “           | $\text{CaO}, \text{SO}_3$                                                    | 2.960             |
| “ “ Crystal.        | $\text{CaO}, \text{SO}_3 + 2\text{HO}$                                       | 2.330             |
| Cobalt “            | $\text{CoO}, \text{SO}_3 + 7\text{HO}$                                       | 1.924             |
| Copper “            | $\text{CuO}, \text{SO}_3$                                                    | 3.572             |
| “ “ Crystal.        | $\text{CuO}, \text{SO}_3 + 5\text{HO}$                                       | 2.300             |
| Iron “              | $\text{FeO}, \text{SO}_3$                                                    | 2.840             |
| “ “ Crystal.        | $\text{FeO}, \text{SO}_3 + 7\text{HO}$                                       | 1.8–1.9           |
| Lead “              | $\text{PbO}, \text{SO}_3$                                                    | 6.300             |
| Lithium, Sulphate   | $\text{LO}, \text{SO}_3$                                                     | 2.210             |
| “ “ Crystal.        | $\text{LO}, \text{SO}_3 + \text{HO}$                                         | 2.020             |
| Magnesia “          | $\text{MgO}, \text{SO}_3$                                                    | 2.600             |
| “ “ Crystal.        | $\text{MgO}, \text{SO}_3 + 7\text{HO}$                                       | 1.750             |
| Manganese “         | $\text{MnO}, \text{SO}_3$                                                    | 3.100             |
| “ “ Crystal.        | $\text{MnO}, \text{SO}_3 + 4\text{HO}$                                       | 2.090             |
| Nickel “            | $\text{NiO}, \text{SO}_3 + 7\text{HO}$                                       | 2.040             |
| Potassium “         | $\text{KO}, \text{SO}_3$                                                     | 2.660             |
| “ “ Acid            | $\text{KO}, 2\text{SO}_3$                                                    | 2.277             |
| Potassa, Alum       | $\text{KO}, \text{SO}_3, \text{Al}_2\text{O}_3, 3\text{SO}_3 + 24\text{HO}$  | 1.724             |
| Silver, Sulphate    | $\text{AgO}, \text{SO}_3$                                                    | 5.400             |
| Sodium “            | $\text{NaO}, \text{SO}_3$                                                    | 2.460             |
| “ “ Crystal.        | $\text{NaO}, \text{SO}_3 + 10\text{HO}$                                      | 1.500             |
| Soda, Alum          | $\text{NaO}, \text{SO}_3, \text{Al}_2\text{O}_3, 3\text{SO}_3 + 24\text{HO}$ | 1.880             |
| Strontium, Sulphate | $\text{SrO}, \text{SO}_3$                                                    | 3.925             |
| Zinc “              | $\text{ZnO}, \text{SO}_3$                                                    | 3.400             |
| “ “ Crystal.        | $\text{ZnO}, \text{SO}_3 + 7\text{HO}$                                       | 1.9–2.1           |



TABLE  
OF THE PER CENT OF DRY AMMONIA GAS IN A SOLUTION AT 14° C.

CARIUS. — Ann. Ch. u. Pharm. 1856, 99, pp. 163, 164.

| Specific Gravity. | Per cent Ammonia. | Specific Gravity. | Per cent Ammonia. | Specific Gravity. | Per cent Ammonia. | Specific Gravity. | Per cent Ammonia. |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0.8844            | 36                | 0.9052            | 27                | 0.9314            | 18                | 0.9631            | 9                 |
| 0.8864            | 35                | 0.9078            | 26                | 0.9347            | 17                | 0.9670            | 8                 |
| 0.8885            | 34                | 0.9106            | 25                | 0.9380            | 16                | 0.9709            | 7                 |
| 0.8907            | 33                | 0.9133            | 24                | 0.9414            | 15                | 0.9749            | 6                 |
| 0.8929            | 32                | 0.9162            | 23                | 0.9449            | 14                | 0.9790            | 5                 |
| 0.8953            | 31                | 0.9191            | 22                | 0.9484            | 13                | 0.9831            | 4                 |
| 0.8976            | 30                | 0.9221            | 21                | 0.9520            | 12                | 0.9873            | 3                 |
| 0.9001            | 29                | 0.9251            | 20                | 0.9556            | 11                | 0.9915            | 2                 |
| 0.9026            | 28                | 0.9283            | 19                | 0.9593            | 10                | 0.9959            | 1                 |

TABLE  
OF THE PER CENT OF DRY AMMONIA GAS IN A SOLUTION AT 16° C.

OTTO'S LEHRBUCH.

| Specific Gravity. | Per cent Ammonia. | Specific Gravity. | Per cent Ammonia. | Specific Gravity. | Per cent Ammonia. | Specific Gravity. | Per cent Ammonia. |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 0.9517            | 12.000            | 0.9583            | 10.250            | 0.9654            | 8.375             | 0.9726            | 6.500             |
| 0.9521            | 11.875            | 0.9588            | 10.125            | 0.9659            | 8.250             | 0.9730            | 6.375             |
| 0.9526            | 11.750            | 0.9593            | 10.000            | 0.9664            | 8.125             | 0.9735            | 6.250             |
| 0.9531            | 11.625            | 0.9597            | 9.875             | 0.9669            | 8.000             | 0.9740            | 6.125             |
| 0.9536            | 11.500            | 0.9602            | 9.750             | 0.9673            | 7.875             | 0.9745            | 6.000             |
| 0.9540            | 11.375            | 0.9607            | 9.625             | 0.9678            | 7.750             | 0.9749            | 5.875             |
| 0.9545            | 11.250            | 0.9612            | 9.500             | 0.9683            | 7.625             | 0.9754            | 5.750             |
| 0.9550            | 11.125            | 0.9616            | 9.375             | 0.9688            | 7.500             | 0.9759            | 5.625             |
| 0.9555            | 11.000            | 0.9621            | 9.250             | 0.9692            | 7.375             | 0.9764            | 5.500             |
| 0.9556            | 10.950            | 0.9626            | 9.125             | 0.9697            | 7.250             | 0.9768            | 5.375             |
| 0.9559            | 10.875            | 0.9631            | 9.000             | 0.9702            | 7.125             | 0.9773            | 5.250             |
| 0.9564            | 10.750            | 0.9636            | 8.875             | 0.9707            | 7.000             | 0.9778            | 5.125             |
| 0.9569            | 10.625            | 0.9641            | 8.750             | 0.9711            | 6.875             | 0.9783            | 5.000             |
| 0.9574            | 10.500            | 0.9645            | 8.625             | 0.9716            | 6.750             |                   |                   |
| 0.9578            | 10.375            | 0.9650            | 8.500             | 0.9721            | 6.625             |                   |                   |

## TABLE

OF THE PER CENT OF POTASSA (KO) IN A SOLUTION AT 15° C.

TÜNNERMANN. — Handwörterbuch, Bd. IV. pp. 253.

| Specific Gravity. | Per cent Potassa. | Specific Gravity. | Per cent Potassa. | Specific Gravity. | Per cent Potassa. |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1.3300            | 28.290            | 1.1979            | 18.671            | 1.0819            | 8.487             |
| 1.3131            | 27.158            | 1.1839            | 17.540            | 1.0703            | 7.355             |
| 1.2966            | 26.027            | 1.1702            | 16.408            | 1.0589            | 6.224             |
| 1.2803            | 24.895            | 1.1568            | 15.277            | 1.0478            | 5.002             |
| 1.2648            | 23.764            | 1.1437            | 14.145            | 1.0369            | 3.961             |
| 1.2493            | 22.632            | 1.1308            | 13.013            | 1.0260            | 2.829             |
| 1.2342            | 21.500            | 1.1182            | 11.882            | 1.0153            | 1.697             |
| 1.2268            | 20.935            | 1.1059            | 10.750            | 1.0050            | 0.5658            |
| 1.2122            | 19.803            | 1.0938            | 9.619             |                   |                   |

## TABLE

OF THE PER CENT OF SODA (NaO) IN A SOLUTION AT 15° C.

TÜNNERMANN. — Handwörterbuch, Bd. V. pp. 522.

| Specific Gravity. | Per cent Soda. | Specific Gravity. | Per cent Soda. | Specific Gravity. | Per cent Soda. |
|-------------------|----------------|-------------------|----------------|-------------------|----------------|
| 1.4285            | 30.220         | 1.2982            | 20.550         | 1.1528            | 10.275         |
| 1.4193            | 29.616         | 1.2912            | 19.945         | 1.1428            | 9.670          |
| 1.4101            | 29.011         | 1.2843            | 19.341         | 1.1330            | 9.066          |
| 1.4011            | 28.407         | 1.2775            | 18.730         | 1.1233            | 8.462          |
| 1.3923            | 27.802         | 1.2708            | 18.132         | 1.1137            | 7.857          |
| 1.3836            | 27.200         | 1.2642            | 17.528         | 1.1042            | 7.253          |
| 1.3751            | 26.594         | 1.2578            | 16.923         | 1.0948            | 6.648          |
| 1.3668            | 25.989         | 1.2515            | 16.319         | 1.0855            | 6.044          |
| 1.3586            | 25.385         | 1.2453            | 15.714         | 1.0764            | 5.440          |
| 1.3505            | 24.780         | 1.2392            | 15.110         | 1.0675            | 4.835          |
| 1.3426            | 24.176         | 1.2280            | 14.506         | 1.0587            | 4.231          |
| 1.3349            | 23.572         | 1.2178            | 13.901         | 1.0500            | 3.626          |
| 1.3273            | 22.967         | 1.2058            | 13.297         | 1.0414            | 3.022          |
| 1.3198            | 22.363         | 1.1948            | 12.692         | 1.0330            | 2.418          |
| 1.3143            | 21.894         | 1.1841            | 12.088         | 1.0246            | 1.813          |
| 1.3125            | 21.758         | 1.1734            | 11.484         | 1.0163            | 1.209          |
| 1.3053            | 21.154         | 1.1630            | 10.879         | 1.0081            | 0.604          |



## TABLE

OF THE SPECIFIC GRAVITY OF SULPHURIC ACID.

*Calculated by Otto from Bineau's data for the Temperature of 15° C.*

| Specific Gravity. | Hydrated Acid. | SO <sub>3</sub> | Specific Gravity. | Hydrated Acid. | SO <sub>3</sub> | Specific Gravity. | Hydrated Acid. | SO <sub>3</sub> |
|-------------------|----------------|-----------------|-------------------|----------------|-----------------|-------------------|----------------|-----------------|
| 1.8426            | 100            | 81.63           | 1.5780            | 66             | 53.87           | 1.2390            | 32             | 26.12           |
| 1.8420            | 99             | 80.81           | 1.5570            | 65             | 53.05           | 1.2310            | 31             | 25.30           |
| 1.8406            | 98             | 80.00           | 1.5450            | 64             | 52.24           | 1.2230            | 30             | 24.49           |
| 1.8400            | 97             | 79.18           | 1.5340            | 63             | 51.42           | 1.2150            | 29             | 23.67           |
| 1.8384            | 96             | 78.36           | 1.5230            | 62             | 50.61           | 1.2066            | 28             | 22.85           |
| 1.8376            | 95             | 77.55           | 1.5120            | 61             | 49.79           | 1.1980            | 27             | 22.03           |
| 1.8356            | 94             | 76.73           | 1.5010            | 60             | 48.98           | 1.1900            | 26             | 21.22           |
| 1.8340            | 93             | 75.91           | 1.4900            | 59             | 48.16           | 1.1820            | 25             | 20.40           |
| 1.8310            | 92             | 75.10           | 1.4800            | 58             | 47.34           | 1.1740            | 24             | 19.58           |
| 1.8270            | 91             | 74.28           | 1.4690            | 57             | 46.53           | 1.1670            | 23             | 18.77           |
| 1.8220            | 90             | 73.47           | 1.4586            | 56             | 45.71           | 1.1590            | 22             | 17.95           |
| 1.8160            | 89             | 72.65           | 1.4480            | 55             | 44.89           | 1.1516            | 21             | 17.14           |
| 1.8090            | 88             | 71.83           | 1.4380            | 54             | 44.07           | 1.1440            | 20             | 16.32           |
| 1.8020            | 87             | 71.02           | 1.4280            | 53             | 43.26           | 1.1360            | 19             | 15.51           |
| 1.7940            | 86             | 70.10           | 1.4180            | 52             | 42.45           | 1.1290            | 18             | 14.69           |
| 1.7860            | 85             | 69.38           | 1.4080            | 51             | 41.63           | 1.1210            | 17             | 13.87           |
| 1.7770            | 84             | 68.57           | 1.3980            | 50             | 40.81           | 1.1136            | 16             | 13.06           |
| 1.7670            | 83             | 67.75           | 1.3886            | 49             | 40.00           | 1.1060            | 15             | 12.24           |
| 1.7560            | 82             | 66.94           | 1.3790            | 48             | 39.18           | 1.0980            | 14             | 11.42           |
| 1.7450            | 81             | 66.12           | 1.3700            | 47             | 38.36           | 1.0910            | 13             | 10.61           |
| 1.7340            | 80             | 65.30           | 1.3610            | 46             | 37.55           | 1.0830            | 12             | 9.79            |
| 1.7220            | 79             | 64.48           | 1.3510            | 45             | 36.73           | 1.0756            | 11             | 8.98            |
| 1.7100            | 78             | 63.67           | 1.3420            | 44             | 35.82           | 1.0680            | 10             | 8.16            |
| 1.6980            | 77             | 62.85           | 1.3330            | 43             | 35.10           | 1.0610            | 9              | 7.34            |
| 1.6860            | 76             | 62.04           | 1.3240            | 42             | 34.28           | 1.0536            | 8              | 6.53            |
| 1.6750            | 75             | 61.22           | 1.3150            | 41             | 33.47           | 1.0464            | 7              | 5.71            |
| 1.6630            | 74             | 60.40           | 1.3060            | 40             | 32.65           | 1.0390            | 6              | 4.89            |
| 1.6510            | 73             | 59.59           | 1.2976            | 39             | 31.83           | 1.0320            | 5              | 4.08            |
| 1.6390            | 72             | 58.77           | 1.2890            | 38             | 31.02           | 1.0256            | 4              | 3.26            |
| 1.6370            | 71             | 57.95           | 1.2810            | 37             | 30.20           | 1.0190            | 3              | 2.445           |
| 1.6150            | 70             | 57.14           | 1.2720            | 36             | 29.38           | 1.0130            | 2              | 1.63            |
| 1.6040            | 69             | 56.32           | 1.2640            | 35             | 28.57           | 1.0064            | 1              | 0.816           |
| 1.5920            | 68             | 55.59           | 1.2560            | 34             | 27.75           |                   |                |                 |
| 1.5800            | 67             | 54.69           | 1.2476            | 33             | 26.94           |                   |                |                 |

## TABLE

OF THE QUANTITY OF SULPHURIC ACID OF 1.86 SPECIFIC GRAVITY  
TO BE ADDED TO 100 PARTS OF WATER TO PRODUCE AN ACID OF  
A GIVEN SPECIFIC GRAVITY.

ANTHON.

| Parts<br>Acid. | Specific<br>Gravity. | Parts<br>Acid. | Specific<br>Gravity. | Parts<br>Acid. | Specific<br>Gravity. |
|----------------|----------------------|----------------|----------------------|----------------|----------------------|
| 1              | 1.009                | 130            | 1.456                | 370            | 1.723                |
| 2              | 1.015                | 140            | 1.473                | 380            | 1.727                |
| 5              | 1.035                | 150            | 1.490                | 390            | 1.730                |
| 10             | 1.060                | 160            | 1.510                | 400            | 1.733                |
| 15             | 1.090                | 170            | 1.530                | 410            | 1.737                |
| 20             | 1.113                | 180            | 1.543                | 420            | 1.740                |
| 25             | 1.140                | 190            | 1.556                | 430            | 1.743                |
| 30             | 1.165                | 200            | 1.568                | 440            | 1.746                |
| 35             | 1.187                | 210            | 1.580                | 450            | 1.750                |
| 40             | 1.210                | 220            | 1.593                | 460            | 1.754                |
| 45             | 1.229                | 230            | 1.606                | 470            | 1.757                |
| 50             | 1.248                | 240            | 1.620                | 480            | 1.760                |
| 55             | 1.265                | 250            | 1.630                | 490            | 1.763                |
| 60             | 1.280                | 260            | 1.640                | 500            | 1.766                |
| 65             | 1.297                | 270            | 1.648                | 510            | 1.768                |
| 70             | 1.312                | 280            | 1.654                | 520            | 1.770                |
| 75             | 1.326                | 290            | 1.667                | 530            | 1.772                |
| 80             | 1.340                | 300            | 1.678                | 540            | 1.774                |
| 85             | 1.357                | 310            | 1.689                | 550            | 1.776                |
| 90             | 1.372                | 320            | 1.700                | 560            | 1.777                |
| 95             | 1.386                | 330            | 1.705                | 580            | 1.778                |
| 100            | 1.398                | 340            | 1.710                | 590            | 1.780                |
| 110            | 1.420                | 350            | 1.714                | 600            | 1.782                |
| 120            | 1.438                | 360            | 1.719                |                |                      |

## TABLE

OF THE SPECIFIC GRAVITY OF NITRIC ACID AT 15° C.

URE. — Diet. Arts.

| Specific Gravity. | Per cent of NO <sub>5</sub> | Specific Gravity. | Per cent of NO <sub>5</sub> | Specific Gravity. | Per cent of NO <sub>5</sub> |
|-------------------|-----------------------------|-------------------|-----------------------------|-------------------|-----------------------------|
| 1.500             | 79.7                        | 1.378             | 52.6                        | 1.190             | 26.3                        |
| 1.498             | 78.9                        | 1.373             | 51.8                        | 1.183             | 25.5                        |
| 1.496             | 78.1                        | 1.368             | 51.1                        | 1.177             | 24.7                        |
| 1.494             | 77.3                        | 1.363             | 50.2                        | 1.171             | 23.9                        |
| 1.491             | 76.5                        | 1.358             | 49.4                        | 1.165             | 23.1                        |
| 1.488             | 75.7                        | 1.353             | 48.6                        | 1.159             | 22.3                        |
| 1.485             | 74.9                        | 1.348             | 47.8                        | 1.153             | 21.5                        |
| 1.482             | 74.1                        | 1.343             | 47.0                        | 1.147             | 20.7                        |
| 1.479             | 73.3                        | 1.338             | 46.2                        | 1.140             | 19.9                        |
| 1.476             | 72.5                        | 1.332             | 45.4                        | 1.134             | 19.1                        |
| 1.473             | 71.7                        | 1.327             | 44.6                        | 1.129             | 18.3                        |
| 1.470             | 70.9                        | 1.322             | 43.8                        | 1.123             | 17.5                        |
| 1.467             | 70.1                        | 1.316             | 43.0                        | 1.117             | 16.7                        |
| 1.464             | 69.3                        | 1.311             | 42.2                        | 1.111             | 15.9                        |
| 1.460             | 68.5                        | 1.306             | 41.4                        | 1.105             | 15.1                        |
| 1.457             | 67.7                        | 1.300             | 40.6                        | 1.099             | 14.3                        |
| 1.453             | 66.9                        | 1.295             | 39.9                        | 1.094             | 13.5                        |
| 1.450             | 66.2                        | 1.289             | 39.1                        | 1.088             | 12.7                        |
| 1.446             | 65.3                        | 1.283             | 38.3                        | 1.082             | 12.0                        |
| 1.442             | 64.6                        | 1.277             | 37.5                        | 1.076             | 11.2                        |
| 1.439             | 63.8                        | 1.271             | 36.7                        | 1.071             | 10.4                        |
| 1.435             | 63.0                        | 1.264             | 35.9                        | 1.065             | 9.6                         |
| 1.431             | 62.2                        | 1.258             | 35.1                        | 1.059             | 8.8                         |
| 1.427             | 61.4                        | 1.252             | 34.3                        | 1.054             | 8.0                         |
| 1.423             | 60.6                        | 1.246             | 33.5                        | 1.048             | 7.2                         |
| 1.419             | 59.8                        | 1.240             | 32.7                        | 1.043             | 6.4                         |
| 1.415             | 59.0                        | 1.234             | 31.9                        | 1.038             | 5.6                         |
| 1.411             | 58.2                        | 1.228             | 31.1                        | 1.032             | 4.8                         |
| 1.407             | 57.4                        | 1.221             | 30.3                        | 1.027             | 4.0                         |
| 1.402             | 56.6                        | 1.215             | 29.5                        | 1.021             | 3.2                         |
| 1.398             | 55.8                        | 1.208             | 28.7                        | 1.016             | 2.4                         |
| 1.395             | 55.0                        | 1.202             | 27.9                        | 1.011             | 1.6                         |
| 1.388             | 54.2                        | 1.196             | 27.1                        | 1.005             | 0.8                         |
| 1.383             | 53.4                        |                   |                             |                   |                             |

## TABLE

OF THE SPECIFIC GRAVITY OF HYDROCHLORIC ACID AT 15° C.

URE. — Dict. Arts.

| Specific Gravity. | Per cent Hydrochloric Acid Gas. | Specific Gravity. | Per cent Hydrochloric Acid Gas. | Specific Gravity. | Per cent Hydrochloric Acid Gas. |
|-------------------|---------------------------------|-------------------|---------------------------------|-------------------|---------------------------------|
| 1.2000            | 40.777                          | 1.1328            | 26.913                          | 1.0657            | 13.456                          |
| 1.1982            | 40.369                          | 1.1308            | 26.505                          | 1.0637            | 13.049                          |
| 1.1964            | 39.961                          | 1.1287            | 26.098                          | 1.0617            | 12.641                          |
| 1.1946            | 39.554                          | 1.1267            | 25.690                          | 1.0597            | 12.233                          |
| 1.1928            | 39.146                          | 1.1247            | 25.282                          | 1.0577            | 11.825                          |
| 1.1910            | 38.738                          | 1.1226            | 24.874                          | 1.0557            | 11.418                          |
| 1.1893            | 38.330                          | 1.1206            | 24.466                          | 1.0537            | 11.010                          |
| 1.1875            | 37.923                          | 1.1185            | 24.058                          | 1.0517            | 10.602                          |
| 1.1857            | 37.516                          | 1.1164            | 23.650                          | 1.0497            | 10.194                          |
| 1.1846            | 37.108                          | 1.1143            | 23.242                          | 1.0477            | 9.786                           |
| 1.1822            | 36.700                          | 1.1123            | 22.834                          | 1.0457            | 9.379                           |
| 1.1802            | 36.292                          | 1.1102            | 22.426                          | 1.0437            | 8.971                           |
| 1.1782            | 35.884                          | 1.1082            | 22.019                          | 1.0417            | 8.563                           |
| 1.1762            | 35.476                          | 1.1061            | 21.611                          | 1.0397            | 8.155                           |
| 1.1741            | 35.068                          | 1.1041            | 21.203                          | 1.0377            | 7.747                           |
| 1.1721            | 34.660                          | 1.1020            | 20.796                          | 1.0357            | 7.340                           |
| 1.1701            | 34.252                          | 1.1000            | 20.388                          | 1.0337            | 6.932                           |
| 1.1681            | 33.845                          | 1.0980            | 19.980                          | 1.0318            | 6.524                           |
| 1.1661            | 33.437                          | 1.0960            | 19.572                          | 1.0298            | 6.116                           |
| 1.1641            | 33.029                          | 1.0939            | 19.165                          | 1.0279            | 5.709                           |
| 1.1620            | 32.621                          | 1.0919            | 18.757                          | 1.0259            | 5.301                           |
| 1.1599            | 32.213                          | 1.0899            | 18.349                          | 1.0239            | 4.893                           |
| 1.1578            | 31.805                          | 1.0879            | 17.941                          | 1.0220            | 4.486                           |
| 1.1557            | 31.398                          | 1.0859            | 17.534                          | 1.0200            | 4.078                           |
| 1.1537            | 30.990                          | 1.0838            | 17.126                          | 1.0180            | 3.670                           |
| 1.1515            | 30.582                          | 1.0818            | 16.718                          | 1.0160            | 3.262                           |
| 1.1494            | 30.174                          | 1.0798            | 16.310                          | 1.0140            | 2.854                           |
| 1.1473            | 29.767                          | 1.0778            | 15.902                          | 1.0120            | 2.447                           |
| 1.1452            | 29.359                          | 1.0758            | 15.494                          | 1.0100            | 2.039                           |
| 1.1431            | 28.951                          | 1.0738            | 15.087                          | 1.0080            | 1.631                           |
| 1.1410            | 28.544                          | 1.0718            | 14.679                          | 1.0060            | 1.124                           |
| 1.1389            | 28.136                          | 1.0697            | 14.271                          | 1.0040            | 0.816                           |
| 1.1369            | 27.728                          | 1.0677            | 13.863                          | 1.0020            | 0.408                           |
| 1.1349            | 27.321                          |                   |                                 |                   |                                 |

## TABLE

OF THE SPECIFIC GRAVITY OF HYDRATED ACETIC ACID.

MOHR. — Ann. Pharm. 1839, 31, s. 234.

| Specific Gravity. | Per cent Hydrated Acetic Acid. | Specific Gravity. | Per cent Hydrated Acetic Acid. | Specific Gravity. | Per cent Hydrated Acetic Acid. | Specific Gravity. | Per cent Hydrated Acetic Acid. |
|-------------------|--------------------------------|-------------------|--------------------------------|-------------------|--------------------------------|-------------------|--------------------------------|
| 1.0635            | 100                            | 1.0720            | 75                             | 1.0600            | 50                             | 1.0340            | 25                             |
| 1.0655            | 99                             | 1.0720            | 74                             | 1.0590            | 49                             | 1.0330            | 24                             |
| 1.0670            | 98                             | 1.0720            | 73                             | 1.0580            | 48                             | 1.0320            | 23                             |
| 1.0680            | 97                             | 1.0710            | 72                             | 1.0560            | 47                             | 1.0310            | 22                             |
| 1.0690            | 96                             | 1.0710            | 71                             | 1.0550            | 46                             | 1.0290            | 21                             |
| 1.0700            | 95                             | 1.0700            | 70                             | 1.0550            | 45                             | 1.0270            | 20                             |
| 1.0706            | 94                             | 1.0700            | 69                             | 1.0540            | 44                             | 1.0260            | 19                             |
| 1.0708            | 93                             | 1.0700            | 68                             | 1.0530            | 43                             | 1.0250            | 18                             |
| 1.0716            | 92                             | 1.0690            | 67                             | 1.0520            | 42                             | 1.0240            | 17                             |
| 1.0721            | 91                             | 1.0690            | 66                             | 1.0515            | 41                             | 1.0230            | 16                             |
| 1.0730            | 90                             | 1.0680            | 65                             | 1.0513            | 40                             | 1.0220            | 15                             |
| 1.0730            | 89                             | 1.0680            | 64                             | 1.0500            | 39                             | 1.0200            | 14                             |
| 1.0730            | 88                             | 1.0680            | 63                             | 1.0490            | 38                             | 1.0180            | 13                             |
| 1.0730            | 87                             | 1.0670            | 62                             | 1.0480            | 37                             | 1.0170            | 12                             |
| 1.0730            | 86                             | 1.0670            | 61                             | 1.0470            | 36                             | 1.0160            | 11                             |
| 1.0730            | 85                             | 1.0670            | 60                             | 1.0460            | 35                             | 1.0150            | 10                             |
| 1.0730            | 84                             | 1.0660            | 59                             | 1.0450            | 34                             | 1.0130            | 9                              |
| 1.0730            | 83                             | 1.0660            | 58                             | 1.0440            | 33                             | 1.0120            | 8                              |
| 1.0730            | 82                             | 1.0650            | 57                             | 1.0424            | 32                             | 1.0100            | 7                              |
| 1.0732            | 81                             | 1.0640            | 56                             | 1.0410            | 31                             | 1.0080            | 6                              |
| 1.0735            | 80                             | 1.0640            | 55                             | 1.0400            | 30                             | 1.0067            | 5                              |
| 1.0735            | 79                             | 1.0630            | 54                             | 1.0390            | 29                             | 1.0055            | 4                              |
| 1.0732            | 78                             | 1.0630            | 53                             | 1.0380            | 28                             | 1.0040            | 3                              |
| 1.0732            | 77                             | 1.0620            | 52                             | 1.0360            | 27                             | 1.0020            | 2                              |
| 1.0730            | 76                             | 1.0610            | 51                             | 1.0350            | 26                             | 1.0010            | 1                              |

When water is added to Hydrated Acetic Acid the Specific Gravity of the fluid does not fall; on the contrary, it rises until 3 atoms or 51.5 per cent have been added.

In reference to this, Thompson gives the following Table.

EQUIVALENTS OF ACID AND WATER AT 15° C.

| Acid. | Water. | Specific Gravity. | Acid. | Water. | Specific Gravity. |
|-------|--------|-------------------|-------|--------|-------------------|
| 1     | 1      | 1.06296           | 1     | 6      | 1.06708           |
| 1     | 2      | 1.07060           | 1     | 7      | 1.06349           |
| 1     | 3      | 1.07084           | 1     | 8      | 1.05974           |
| 1     | 4      | 1.07132           | 1     | 9      | 1.05794           |
| 1     | 5      | 1.06820           | 1     | 10     | 1.05439           |



## TABLE

OF THE PROPORTION BY WEIGHT OF ABSOLUTE ALCOHOL IN SPIRITS  
OF DIFFERENT SPECIFIC GRAVITIES AT 15°.5 C.

FOWNES'S Chem., p. 579.

| Specific Gravity. | Per cent.     | Specific Gravity. | Per cent. | Specific Gravity. | Per cent. |
|-------------------|---------------|-------------------|-----------|-------------------|-----------|
| 0.9991            | $\frac{1}{2}$ | 0.9511            | 34        | 0.8769            | 68        |
| 0.9981            | 1             | 0.9490            | 35        | 0.8745            | 69        |
| 0.9965            | 2             | 0.9470            | 36        | 0.8721            | 70        |
| 0.9947            | 3             | 0.9452            | 37        | 0.8696            | 71        |
| 0.9930            | 4             | 0.9434            | 38        | 0.8672            | 72        |
| 0.9914            | 5             | 0.9416            | 39        | 0.8649            | 73        |
| 0.9898            | 6             | 0.9396            | 40        | 0.8625            | 74        |
| 0.9884            | 7             | 0.9376            | 41        | 0.8603            | 75        |
| 0.9869            | 8             | 0.9356            | 42        | 0.8581            | 76        |
| 0.9855            | 9             | 0.9335            | 43        | 0.8557            | 77        |
| 0.9841            | 10            | 0.9314            | 44        | 0.8533            | 78        |
| 0.9828            | 11            | 0.9292            | 45        | 0.8508            | 79        |
| 0.9815            | 12            | 0.9270            | 46        | 0.8483            | 80        |
| 0.9802            | 13            | 0.9249            | 47        | 0.8459            | 81        |
| 0.9789            | 14            | 0.9228            | 48        | 0.8434            | 82        |
| 0.9778            | 15            | 0.9206            | 49        | 0.8408            | 83        |
| 0.9766            | 16            | 0.9184            | 50        | 0.8382            | 84        |
| 0.9753            | 17            | 0.9160            | 51        | 0.8357            | 85        |
| 0.9741            | 18            | 0.9135            | 52        | 0.8331            | 86        |
| 0.9728            | 19            | 0.9113            | 53        | 0.8305            | 87        |
| 0.9716            | 20            | 0.9090            | 54        | 0.8279            | 88        |
| 0.9704            | 21            | 0.9069            | 55        | 0.8254            | 89        |
| 0.9691            | 22            | 0.9047            | 56        | 0.8228            | 90        |
| 0.9678            | 23            | 0.9025            | 57        | 0.8199            | 91        |
| 0.9665            | 24            | 0.9001            | 58        | 0.8172            | 92        |
| 0.9652            | 25            | 0.8979            | 59        | 0.8145            | 93        |
| 0.9638            | 26            | 0.8956            | 60        | 0.8118            | 94        |
| 0.9623            | 27            | 0.8932            | 61        | 0.8089            | 95        |
| 0.9609            | 28            | 0.8908            | 62        | 0.8061            | 96        |
| 0.9593            | 29            | 0.8886            | 63        | 0.8031            | 97        |
| 0.9578            | 30            | 0.8863            | 64        | 0.8001            | 98        |
| 0.9560            | 31            | 0.8840            | 65        | 0.7969            | 99        |
| 0.9544            | 32            | 0.8816            | 66        | 0.7938            | 100       |
| 0.9528            | 33            | 0.8793            | 67        |                   |           |



## TABLE

OF THE SPECIFIC GRAVITY OF A MIXTURE OF ALCOHOL AND WATER  
BY VOLUME.

*Temperature = 15°.56 C. Water = 1 at 3°.9 C.*

TRALLES. — Gilbert's Annalen der Phys., 1811, 38, s. 368.

| Per cent<br>Alcohol. | Specific<br>Gravity. | Per cent<br>Alcohol. | Specific<br>Gravity. | Per cent<br>Alcohol. | Specific<br>Gravity. |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| 1                    | 9976                 | 35                   | 9583                 | 68                   | 8941                 |
| 2                    | 9961                 | 36                   | 9570                 | 69                   | 8917                 |
| 3                    | 9947                 | 37                   | 9559                 | 70                   | 8892                 |
| 4                    | 9933                 | 38                   | 9541                 | 71                   | 8867                 |
| 5                    | 9919                 | 39                   | 9526                 | 72                   | 8842                 |
| 6                    | 9906                 | 40                   | 9510                 | 73                   | 8817                 |
| 7                    | 9893                 | 41                   | 9494                 | 74                   | 8791                 |
| 8                    | 9881                 | 42                   | 9478                 | 75                   | 8765                 |
| 9                    | 9869                 | 43                   | 9461                 | 76                   | 8739                 |
| 10                   | 9857                 | 44                   | 9444                 | 77                   | 8712                 |
| 11                   | 9845                 | 45                   | 9427                 | 78                   | 8685                 |
| 12                   | 9834                 | 46                   | 9409                 | 79                   | 8658                 |
| 13                   | 9823                 | 47                   | 9391                 | 80                   | 8631                 |
| 14                   | 9812                 | 48                   | 9373                 | 81                   | 8603                 |
| 15                   | 9802                 | 49                   | 9354                 | 82                   | 8575                 |
| 16                   | 9791                 | 50                   | 9335                 | 83                   | 8547                 |
| 17                   | 9781                 | 51                   | 9315                 | 84                   | 8518                 |
| 18                   | 9771                 | 52                   | 9295                 | 85                   | 8488                 |
| 19                   | 9761                 | 53                   | 9275                 | 86                   | 8458                 |
| 20                   | 9751                 | 54                   | 9254                 | 87                   | 8428                 |
| 21                   | 9741                 | 55                   | 9234                 | 88                   | 8397                 |
| 22                   | 9731                 | 56                   | 9213                 | 89                   | 8365                 |
| 23                   | 9720                 | 57                   | 9192                 | 90                   | 8332                 |
| 24                   | 9710                 | 58                   | 9170                 | 91                   | 8299                 |
| 25                   | 9700                 | 59                   | 9148                 | 92                   | 8265                 |
| 26                   | 9689                 | 60                   | 9126                 | 93                   | 8230                 |
| 27                   | 9679                 | 61                   | 9104                 | 94                   | 8194                 |
| 28                   | 9668                 | 62                   | 9082                 | 95                   | 8157                 |
| 29                   | 9657                 | 63                   | 9059                 | 96                   | 8118                 |
| 30                   | 9646                 | 64                   | 9036                 | 97                   | 8077                 |
| 31                   | 9634                 | 65                   | 9013                 | 98                   | 8034                 |
| 32                   | 9622                 | 66                   | 8989                 | 99                   | 7988                 |
| 33                   | 9609                 | 67                   | 8965                 | 100                  | 7939                 |
| 34                   | 9596                 |                      |                      |                      |                      |

## TABLE

FOR THE MIXING OF WATER AND ALCOHOL ACCORDING TO  
VOLUME, AT 17°.5 C.

MEISSNER'S *Aräometrie*.

| A mixture of     |                | Specific Gravity. | The Volume becomes after mixing. | A mixture of     |                | Specific Gravity. | The Volume becomes after mixing. | A mixture of     |                | Specific Gravity. | The Volume becomes after mixing. |
|------------------|----------------|-------------------|----------------------------------|------------------|----------------|-------------------|----------------------------------|------------------|----------------|-------------------|----------------------------------|
| Volumes Alcohol. | Volumes Water. |                   |                                  | Volumes Alcohol. | Volumes Water. |                   |                                  | Volumes Alcohol. | Volumes Water. |                   |                                  |
| 100              | 0              | 0.7932            |                                  | 66               | 34             | 0.8934            | 96.651                           | 32               | 68             | 0.9621            | 97.056                           |
| 99               | 1              | 0.7969            | 99.802                           | 65               | 35             | 0.8958            | 96.626                           | 31               | 69             | 0.9632            | 97.158                           |
| 98               | 2              | 0.8006            | 99.618                           | 64               | 36             | 0.8982            | 96.602                           | 30               | 70             | 0.9643            | 97.268                           |
| 97               | 3              | 0.8042            | 99.425                           | 63               | 37             | 0.9006            | 96.580                           | 29               | 71             | 0.9654            | 97.367                           |
| 96               | 4              | 0.8078            | 89.229                           | 62               | 38             | 0.9029            | 96.559                           | 28               | 72             | 0.9665            | 97.466                           |
| 95               | 5              | 0.8114            | 99.031                           | 61               | 39             | 0.9052            | 96.539                           | 27               | 73             | 0.9676            | 97.565                           |
| 94               | 6              | 0.8150            | 98.824                           | 60               | 40             | 0.9075            | 96.520                           | 26               | 74             | 0.9688            | 97.664                           |
| 93               | 7              | 0.8185            | 98.644                           | 59               | 41             | 0.9098            | 96.501                           | 25               | 75             | 0.9700            | 97.763                           |
| 92               | 8              | 0.8219            | 98.484                           | 58               | 42             | 0.9121            | 96.484                           | 24               | 76             | 0.9712            | 97.862                           |
| 91               | 9              | 0.8253            | 98.334                           | 57               | 43             | 0.9145            | 96.463                           | 23               | 77             | 0.9723            | 97.958                           |
| 90               | 10             | 0.8286            | 98.224                           | 56               | 44             | 0.9168            | 96.445                           | 22               | 78             | 0.9734            | 98.051                           |
| 89               | 11             | 0.8317            | 98.131                           | 55               | 45             | 0.9191            | 96.427                           | 21               | 79             | 0.9745            | 98.149                           |
| 88               | 12             | 0.8346            | 98.044                           | 54               | 46             | 0.9214            | 96.413                           | 20               | 80             | 0.9756            | 98.262                           |
| 87               | 13             | 0.8373            | 97.962                           | 53               | 47             | 0.9237            | 96.402                           | 19               | 81             | 0.9766            | 98.377                           |
| 86               | 14             | 0.8400            | 97.883                           | 52               | 48             | 0.9259            | 96.393                           | 18               | 82             | 0.9775            | 98.494                           |
| 85               | 15             | 0.8427            | 97.807                           | 51               | 49             | 0.9281            | 96.384                           | 17               | 83             | 0.9784            | 98.613                           |
| 84               | 16             | 0.8454            | 97.733                           | 50               | 50             | 0.9303            | 96.377                           | 16               | 84             | 0.9793            | 98.731                           |
| 83               | 17             | 0.8481            | 97.661                           | 49               | 51             | 0.9324            | 96.384                           | 15               | 85             | 0.9803            | 98.845                           |
| 82               | 18             | 0.8508            | 97.592                           | 48               | 52             | 0.9344            | 96.394                           | 14               | 86             | 0.9813            | 98.955                           |
| 81               | 19             | 0.8534            | 97.525                           | 47               | 53             | 0.9364            | 96.407                           | 13               | 87             | 0.9823            | 99.058                           |
| 80               | 20             | 0.8566            | 97.462                           | 46               | 54             | 0.9384            | 96.423                           | 12               | 88             | 0.9834            | 99.154                           |
| 79               | 21             | 0.8591            | 97.401                           | 45               | 55             | 0.9404            | 96.442                           | 11               | 89             | 0.9846            | 99.246                           |
| 78               | 22             | 0.8616            | 97.347                           | 44               | 56             | 0.9424            | 96.465                           | 10               | 90             | 0.9859            | 99.333                           |
| 77               | 23             | 0.8642            | 97.291                           | 43               | 57             | 0.9443            | 96.495                           | 9                | 91             | 0.9873            | 99.413                           |
| 76               | 24             | 0.8668            | 97.234                           | 42               | 58             | 0.9461            | 96.528                           | 8                | 92             | 0.9888            | 99.487                           |
| 75               | 25             | 0.8695            | 97.176                           | 41               | 59             | 0.9478            | 96.565                           | 7                | 93             | 0.9901            | 99.555                           |
| 74               | 26             | 0.8723            | 97.111                           | 40               | 60             | 0.9495            | 96.607                           | 6                | 94             | 0.9915            | 99.617                           |
| 73               | 27             | 0.8751            | 97.040                           | 39               | 61             | 0.9512            | 96.649                           | 5                | 95             | 0.9929            | 99.674                           |
| 72               | 28             | 0.8779            | 96.966                           | 38               | 62             | 0.9529            | 96.692                           | 4                | 96             | 0.9943            | 99.731                           |
| 71               | 29             | 0.8806            | 96.892                           | 37               | 63             | 0.9547            | 96.736                           | 3                | 97             | 0.9957            | 99.792                           |
| 70               | 30             | 0.8833            | 96.821                           | 36               | 64             | 0.9564            | 96.782                           | 2                | 98             | 0.9971            | 99.857                           |
| 69               | 31             | 0.8860            | 96.765                           | 35               | 65             | 0.9580            | 96.829                           | 1                | 99             | 0.9985            | 99.927                           |
| 68               | 32             | 0.8885            | 96.723                           | 34               | 66             | 0.9595            | 96.889                           | 0                | 100            | 1.0000            |                                  |
| 67               | 33             | 0.8910            | 96.685                           | 33               | 67             | 0.9609            | 96.967                           |                  |                |                   |                                  |

## TABLE

FOR THE MIXING OF ALCOHOL AND WATER BY WEIGHT AT 17°.5 C.

MEISSNER'S Aräometrie.

| Parts<br>Alcohol. | Parts<br>Water. | Specific<br>Gravity. | Parts<br>Alcohol. | Parts<br>Water. | Specific<br>Gravity. | Parts<br>Alcohol. | Parts<br>Water. | Specific<br>Gravity. |
|-------------------|-----------------|----------------------|-------------------|-----------------|----------------------|-------------------|-----------------|----------------------|
| 100               | 0               | 0.7932               | 66                | 34              | 0.8806               | 32                | 68              | 0.9548               |
| 99                | 1               | 0.7960               | 65                | 35              | 0.8831               | 31                | 69              | 0.9561               |
| 98                | 2               | 0.7988               | 64                | 36              | 0.8855               | 30                | 70              | 0.9578               |
| 97                | 3               | 0.8016               | 63                | 37              | 0.8879               | 29                | 71              | 0.9594               |
| 96                | 4               | 0.8045               | 62                | 38              | 0.8902               | 28                | 72              | 0.9608               |
| 95                | 5               | 0.8074               | 61                | 39              | 0.8925               | 27                | 73              | 0.9621               |
| 94                | 6               | 0.8104               | 60                | 40              | 0.8948               | 26                | 74              | 0.9634               |
| 93                | 7               | 0.8135               | 59                | 41              | 0.8971               | 25                | 75              | 0.9647               |
| 92                | 8               | 0.8166               | 58                | 42              | 0.8994               | 24                | 76              | 0.9660               |
| 91                | 9               | 0.8196               | 57                | 43              | 0.9016               | 23                | 77              | 0.9673               |
| 90                | 10              | 0.8225               | 56                | 44              | 0.9038               | 22                | 78              | 0.9686               |
| 89                | 11              | 0.8252               | 55                | 45              | 0.9060               | 21                | 79              | 0.9699               |
| 88                | 12              | 0.8279               | 54                | 46              | 0.9082               | 20                | 80              | 0.9712               |
| 87                | 13              | 0.8304               | 53                | 47              | 0.9104               | 19                | 81              | 0.9725               |
| 86                | 14              | 0.8329               | 52                | 48              | 0.9127               | 18                | 82              | 0.9738               |
| 85                | 15              | 0.8353               | 51                | 49              | 0.9150               | 17                | 83              | 0.9751               |
| 84                | 16              | 0.8376               | 50                | 50              | 0.9173               | 16                | 84              | 0.9763               |
| 83                | 17              | 0.8399               | 49                | 51              | 0.9196               | 15                | 85              | 0.9775               |
| 82                | 18              | 0.8422               | 48                | 52              | 0.9219               | 14                | 86              | 0.9786               |
| 81                | 19              | 0.8446               | 47                | 53              | 0.9242               | 13                | 87              | 0.9796               |
| 80                | 20              | 0.8470               | 46                | 54              | 0.9264               | 12                | 88              | 0.9806               |
| 79                | 21              | 0.8494               | 45                | 55              | 0.9280               | 11                | 89              | 0.9817               |
| 78                | 22              | 0.8519               | 44                | 56              | 0.9308               | 10                | 90              | 0.9830               |
| 77                | 23              | 0.8543               | 43                | 57              | 0.9329               | 9                 | 91              | 0.9844               |
| 76                | 24              | 0.8567               | 42                | 58              | 0.9350               | 8                 | 92              | 0.9860               |
| 75                | 25              | 0.8590               | 41                | 59              | 0.9371               | 7                 | 93              | 0.9878               |
| 74                | 26              | 0.8613               | 40                | 60              | 0.9391               | 6                 | 94              | 0.9897               |
| 73                | 27              | 0.8635               | 39                | 61              | 0.9410               | 5                 | 95              | 0.9914               |
| 72                | 28              | 0.8657               | 38                | 62              | 0.9429               | 4                 | 96              | 0.9931               |
| 71                | 29              | 0.8680               | 37                | 63              | 0.9448               | 3                 | 97              | 0.9948               |
| 70                | 30              | 0.8704               | 36                | 64              | 0.9467               | 2                 | 98              | 0.9965               |
| 69                | 31              | 0.8729               | 35                | 65              | 0.9486               | 1                 | 99              | 0.9982               |
| 68                | 32              | 0.8755               | 34                | 66              | 0.9505               | 0                 | 100             | 1.0000               |
| 67                | 33              | 0.8781               | 33                | 67              | 0.9524               |                   |                 |                      |

## TABLE

OF THE PER CENT OF COMMON SALT (NaCl) IN SOLUTIONS OF 1.001  
TO 1.20467 SPECIFIC GRAVITY, AT 18°.75 C.

MUSPRATT'S Chemie.

| Specific Gravity. | Per cent. | Specific Gravity. | Per cent. | Specific Gravity. | Per cent. |
|-------------------|-----------|-------------------|-----------|-------------------|-----------|
| 1.001             | 0.1361    | 1.034             | 4.7038    | 1.067             | 9.2055    |
| 1.002             | 0.2731    | 1.035             | 4.8417    | 1.068             | 9.3402    |
| 1.003             | 0.4105    | 1.036             | 4.9795    | 1.069             | 9.4747    |
| 1.004             | 0.5483    | 1.037             | 5.1172    | 1.070             | 9.6091    |
| 1.005             | 0.6863    | 1.038             | 5.2549    | 1.071             | 9.7434    |
| 1.006             | 0.8245    | 1.039             | 5.3925    | 1.072             | 9.8776    |
| 1.007             | 0.9628    | 1.040             | 5.5300    | 1.073             | 10.0117   |
| 1.008             | 1.1013    | 1.041             | 5.6674    | 1.074             | 10.1457   |
| 1.009             | 1.2398    | 1.042             | 5.8047    | 1.075             | 10.2795   |
| 1.010             | 1.3785    | 1.043             | 5.9420    | 1.076             | 10.4132   |
| 1.011             | 1.5172    | 1.044             | 6.0791    | 1.077             | 10.5469   |
| 1.012             | 1.6559    | 1.045             | 6.2161    | 1.078             | 10.6804   |
| 1.013             | 1.7947    | 1.046             | 6.3531    | 1.079             | 10.8137   |
| 1.014             | 1.9335    | 1.047             | 6.4900    | 1.080             | 10.9470   |
| 1.015             | 2.0723    | 1.048             | 6.6267    | 1.081             | 11.0802   |
| 1.016             | 2.2111    | 1.049             | 6.7634    | 1.082             | 11.2132   |
| 1.017             | 2.3499    | 1.050             | 6.9000    | 1.083             | 11.3461   |
| 1.018             | 2.4887    | 1.051             | 7.0364    | 1.084             | 11.4789   |
| 1.019             | 2.6275    | 1.052             | 7.1728    | 1.085             | 11.6116   |
| 1.020             | 2.7662    | 1.053             | 7.3090    | 1.086             | 11.7441   |
| 1.021             | 2.9049    | 1.054             | 7.4452    | 1.087             | 11.8766   |
| 1.022             | 3.0436    | 1.055             | 7.5812    | 1.088             | 12.0089   |
| 1.023             | 3.1823    | 1.056             | 7.7172    | 1.089             | 12.1411   |
| 1.024             | 3.3209    | 1.057             | 7.8530    | 1.090             | 12.2732   |
| 1.025             | 3.4594    | 1.058             | 7.9888    | 1.091             | 12.4052   |
| 1.026             | 3.5979    | 1.059             | 8.1244    | 1.092             | 12.5370   |
| 1.027             | 3.7364    | 1.060             | 8.2599    | 1.093             | 12.6687   |
| 1.028             | 3.8748    | 1.061             | 8.3953    | 1.094             | 12.8004   |
| 1.029             | 4.0131    | 1.062             | 8.5307    | 1.095             | 12.9318   |
| 1.030             | 4.1514    | 1.063             | 8.6659    | 1.096             | 13.0632   |
| 1.031             | 4.2896    | 1.064             | 8.8009    | 1.097             | 13.1945   |
| 1.032             | 4.4277    | 1.065             | 8.9359    | 1.098             | 13.3256   |
| 1.033             | 4.5658    | 1.066             | 9.0708    | 1.099             | 13.4566   |

| Specific Gravity. | Per cent. | Specific Gravity. | Per cent. | Specific Gravity. | Per cent. |
|-------------------|-----------|-------------------|-----------|-------------------|-----------|
| 1.100             | 13.5875   | 1.136             | 18.2189   | 1.171             | 22.5726   |
| 1.101             | 13.7183   | 1.137             | 18.3454   | 1.172             | 22.6949   |
| 1.102             | 13.8489   | 1.138             | 18.4717   | 1.173             | 22.8170   |
| 1.103             | 13.9794   | 1.139             | 18.5978   | 1.174             | 22.9390   |
| 1.104             | 14.1098   | 1.140             | 18.7239   | 1.175             | 23.0610   |
| 1.105             | 14.2401   | 1.141             | 18.8498   | 1.176             | 23.1828   |
| 1.106             | 14.3703   | 1.142             | 18.9757   | 1.177             | 23.3045   |
| 1.107             | 14.5003   | 1.143             | 19.1014   | 1.178             | 23.4260   |
| 1.108             | 14.6302   | 1.144             | 19.2269   | 1.179             | 23.5475   |
| 1.109             | 14.7600   | 1.145             | 19.3524   | 1.180             | 23.6688   |
| 1.110             | 14.8897   | 1.146             | 19.4777   | 1.181             | 23.7900   |
| 1.111             | 15.0193   | 1.147             | 19.6029   | 1.182             | 23.9111   |
| 1.112             | 15.1487   | 1.148             | 19.7280   | 1.183             | 24.0321   |
| 1.113             | 15.2780   | 1.149             | 19.8530   | 1.184             | 24.1530   |
| 1.114             | 15.4072   | 1.150             | 19.9779   | 1.185             | 24.2738   |
| 1.115             | 15.5363   | 1.151             | 20.1026   | 1.186             | 24.3945   |
| 1.116             | 15.6653   | 1.152             | 20.2272   | 1.187             | 24.5150   |
| 1.117             | 15.7941   | 1.153             | 20.3517   | 1.188             | 24.6354   |
| 1.118             | 15.9228   | 1.154             | 20.4761   | 1.189             | 24.7557   |
| 1.119             | 16.0514   | 1.155             | 20.6004   | 1.190             | 24.8759   |
| 1.120             | 16.1799   | 1.156             | 20.7245   | 1.191             | 24.9960   |
| 1.121             | 16.3082   | 1.157             | 20.8486   | 1.192             | 25.1159   |
| 1.122             | 16.4365   | 1.158             | 20.9725   | 1.193             | 25.2358   |
| 1.123             | 16.5645   | 1.159             | 21.0963   | 1.194             | 25.3555   |
| 1.124             | 16.6925   | 1.160             | 21.2199   | 1.195             | 25.4752   |
| 1.125             | 16.8204   | 1.161             | 21.3435   | 1.196             | 25.5947   |
| 1.126             | 16.9482   | 1.162             | 21.4669   | 1.197             | 25.7141   |
| 1.127             | 17.0758   | 1.163             | 21.5903   | 1.198             | 25.8333   |
| 1.128             | 17.2033   | 1.164             | 21.7135   | 1.199             | 25.9525   |
| 1.129             | 17.3307   | 1.165             | 21.8365   | 1.200             | 26.0716   |
| 1.130             | 17.4579   | 1.166             | 21.9595   | 1.201             | 26.1905   |
| 1.131             | 17.5851   | 1.167             | 22.0824   | 1.202             | 26.3094   |
| 1.132             | 17.7121   | 1.168             | 22.2051   | 1.203             | 26.4281   |
| 1.133             | 17.8390   | 1.169             | 22.3277   | 1.204             | 26.5467   |
| 1.134             | 17.9657   | 1.170             | 22.4502   | 1.20467           | 26.6261   |
| 1.135             | 18.0924   |                   |           |                   |           |







T A B L E S

RELATING TO HEAT.



TABLE  
OF THE SPECIFIC AND ATOMIC HEAT OF THE ELEMENTS.  
*Calculated from Regnault's data.*

| Name of Element. | Specific Heat. | Atomic Weight. | Specific Heat X Atomic Weight. | Name of Element. | Specific Heat. | Atomic Weight. | Specific Heat X Atomic Weight. |
|------------------|----------------|----------------|--------------------------------|------------------|----------------|----------------|--------------------------------|
| Diamond          | 0.14680        | 48.0 ?         | 6.04640                        | Mercury, Solid   | 0.03192        | 200.0          | 6.38400                        |
| Graphite         | 0.20180        | 33.0 ?         | 6.65940                        | “ Liquid         | 0.03332        | 200.0          | 6.66400                        |
| Wood, Charcoal   | 0.24150        |                |                                | Platinum         | 0.03243        | 198.0          | 6.42114                        |
| Silicon, fused   | 0.17500        | 35.0 ?         | 6.12500                        | Palladium        | 0.05927        | 106.4          | 6.30630                        |
| “ Crystallized   | 0.17670        |                |                                | Rhodium          | 0.05803        | 104.0          | 6.03510                        |
| Boron            | 0.25000        |                |                                | Osmium           | 0.03063        | 194.0          | 5.94220                        |
| Sulphur (Native) | 0.17760        | 32.0           | 5.68320                        | Iridium          | 0.03259        | 196.0          | 6.38760                        |
| Selenium         | 0.08370        | 79.0           | 6.61230                        | Iodine           | 0.05412        | 127.0          | 6.87320                        |
| Tellurium        | 0.04737        | 128.0          | 6.06330                        | Bromine, Solid   | 0.08430        | 80.0           | 6.74400                        |
| Magnesium        | 0.24990        | 24.0           | 5.99760                        | “ Liquid         | 0.10600        | 80.0           | 8.48000                        |
| Zinc             | 0.09555        | 65.0           | 6.25880                        | Potassium        | 0.16956        | 39.0           | 6.61280                        |
| Cadmium          | 0.05669        | 112.0          | 6.34820                        | Sodium           | 0.29340        | 23.0           | 6.74800                        |
| Aluminium        | 0.21430        | 27.5           | 5.87300                        | Lithium          | 0.94080        | 7.0            | 6.58560                        |
| Iron             | 0.11379        | 56.0           | 6.37220                        | Phosphorus       | 0.18870        | 31.0           | 5.84970                        |
| Nickel           | 0.10863        | 58.0           | 6.30054                        | Arsenic          | 0.08140        | 75.0           | 6.10500                        |
| Cobalt           | 0.10696        | 60.0           | 6.41760                        | Antimony         | 0.05077        | 120.0          | 6.09240                        |
| Manganese        | 0.12170        | 54.0           | 6.57180                        | Bismuth          | 0.03084        | 208.0          | 6.41472                        |
| Tin              | 0.05623        | 116.0          | 6.52268                        | Thallium         | 0.03355        | 204.0          | 6.84420                        |
| Tungsten         | 0.03342        | 184.0          | 6.14920                        | Silver           | 0.05701        | 108.0          | 6.15700                        |
| Copper           | 0.09515        | 63.5           | 6.04190                        | Gold             | 0.03244        | 197.0          | 6.39068                        |
| Lead             | 0.03140        | 207.0          | 6.49990                        |                  |                |                |                                |

## TABLE

OF SPECIFIC HEATS OF SOME OF THE MOST COMMON SUBSTANCES.

REGNAULT. — Annales de Chimie et de Physique, III, I., p. 172.

| Name.                      | Specific Heat. | Name.                        | Specific Heat. |
|----------------------------|----------------|------------------------------|----------------|
| Protoxide of Lead, powder. | 0.05118        | Bisulphide of Iron (Pyrites) | 0.13009        |
| “ fused                    | 0.05089        | “ Tin                        | 0.11932        |
| Oxide of Mercury (HgO)     | 0.05179        | “ Molybdenum                 | 0.12334        |
| Protoxide of Manganese     | 0.15701        | Subsulphide of Copper        | 0.12118        |
| Oxide of Copper            | 0.14201        | “ Silver                     | 0.07460        |
| “ Nickel                   | 0.16234        | Magnetic Pyrites             | 0.16023        |
| “ “ calcined               | 0.15885        | Chloride of Sodium           | 0.21401        |
| Magnesia                   | 0.24394        | Chloride of Potassium        | 0.17295        |
| Oxide of Zinc              | 0.12480        | Subchloride of Mercury       | 0.05205        |
| Sesquioxide of Iron        | 0.16695        | “ Copper                     | 0.13827        |
| Arsenous Acid              | 0.12786        | Chloride of Silver           | 0.09109        |
| Sesquioxide of Chromium    | 0.17960        | “ Barium                     | 0.08570        |
| Oxide of Bismuth           | 0.06053        | “ Strontium                  | 0.11990        |
| Teroxide of Antimony       | 0.09009        | “ Calcium                    | 0.16420        |
| Corundum                   | 0.19762        | “ Magnesium                  | 0.19460        |
| Sapphire                   | 0.21732        | “ Lead                       | 0.06641        |
| Stannic Acid               | 0.09382        | “ Mercury                    | 0.06889        |
| Titanic Acid, artificial   | 0.17164        | “ Zinc                       | 0.13618        |
| “ rutile                   | 0.17032        | “ Tin                        | 0.10161        |
| Tungstic Acid              | 0.07983        | “ Manganese                  | 0.14255        |
| Molybdic Acid              | 0.13240        | Bichloride of Tin            | 0.14759        |
| Silica                     | 0.19132        | “ Titanium                   | 0.19145        |
| Boric Acid                 | 0.23743        | Terchloride of Arsenic       | 0.17478        |
| Magnetic Oxide of Iron     | 0.16780        | “ Phosphorus                 | 0.20922        |
| Protosulphide of Iron      | 0.13570        | Bromide of Potassium         | 0.11322        |
| Sulphide of Nickel         | 0.12814        | “ Silver                     | 0.07391        |
| “ Cobalt                   | 0.12512        | “ Sodium                     | 0.13842        |
| “ Zinc                     | 0.12303        | “ Lead                       | 0.05326        |
| “ Lead                     | 0.05086        | Iodide of Potassium          | 0.08191        |
| “ Mercury                  | 0.05117        | “ Sodium                     | 0.08684        |
| “ Tin                      | 0.08365        | Subiodide of Mercury         | 0.03949        |
| “ Antimony                 | 0.08403        | Iodide of Silver             | 0.06159        |
| “ Bismuth                  | 0.06002        | Subiodide of Copper          | 0.06869        |

| Name.                      | Specific Heat. | Name.                   | Specific Heat. |
|----------------------------|----------------|-------------------------|----------------|
| Iodide of Lead             | 0.04267        | Sulphate of Magnesium   | 0.22159        |
| “ Mercury                  | 0.04197        | Chromate of Potassium   | 0.18505        |
| Fluoride of Calcium        | 0.21492        | Bichromate of Potassium | 0.18937        |
| Nitrate of Potassium       | 0.23875        | Biborate “              | 0.21975        |
| “ Sodium                   | 0.27821        | “ Sodium                | 0.23823        |
| “ Silver                   | 0.14352        | “ Lead                  | 0.11409        |
| “ Barium                   | 0.15228        | Borate of Potassium     | 0.20478        |
| Chlorate of Potassium      | 0.10956        | “ Sodium                | 0.25709        |
| Pyrophosphate of Potassium | 0.19102        | “ Lead                  | 0.09046        |
| “ Sodium                   | 0.22833        | Wolfram                 | 0.09780        |
| “ Lead                     | 0.08208        | Zircon                  | 0.14558        |
| Metaphosphate of Calcium   | 0.19923        | Carbonate of Potassium  | 0.21623        |
| Phosphate of Lead          | 0.07982        | “ Sodium                | 0.27275        |
| Arsenate of Potassium      | 0.15631        | Iceland Spar            | 0.20858        |
| “ Lead                     | 0.07280        | Arragonite              | 0.20850        |
| Sulphate of Potassium      | 0.19010        | White Granular Marble   | 0.21585        |
| “ Sodium                   | 0.23115        | Gray “                  | 0.20989        |
| “ Barium                   | 0.11285        | White Chalk             | 0.21401        |
| “ Strontium                | 0.14279        | Carbonate of Barium     | 0.11038        |
| “ Lead                     | 0.08723        | “ Iron                  | 0.19345        |
| “ Calcium                  | 0.19656        | “ Strontium             | 0.14483        |

## LATENT HEAT OF VAPORIZATION.

\* FAVRE AND SILBERMAN. — Ann. Chem. Phys. [3] XXXVII. p. 464-470.

† ANDREWS. — Chem. Soc. Qu. Jour. I. p. 27.

| Substance.                | Latent heat of Vapor. | Substance.         | Latent heat of Vapor. |
|---------------------------|-----------------------|--------------------|-----------------------|
| Bromine                   | 45.60†                | Butyric Acid       | 114.67*               |
| Terchloride of Phosphorus | 51.42†                | Acetate of Ethyl   | 105.80*               |
| Sulphide of Carbon        | 86.67†                | “ “                | 92.68†                |
| Bichloride of Tin         | 3.05†                 | Acetate of Methyl  | 110.20†               |
| Alcohol                   | 208.92*               | Formate of Ethyl   | 105.30†               |
| “                         | 202.40†               | “ Methyl           | 117.10†               |
| Methylic Alcohol          | 263.86*               | Iodide of Ethyl    | 46.87†                |
| “ “                       | 263.70†               | “ Methyl           | 46.07†                |
| Amylic Alcohol            | 121.37*               | Oxalate of Ethyl   | 72.72†                |
| Acetic Acid               | 101.91*               | Butyrate of Methyl | 87.33*                |
| Formic Acid               | 120.72*               | Ethyl              | 58.44*                |
| Ether                     | 91.11*                | Oil of Turpentine  | 68.73*                |
| “                         | 90.45†                | Terebene           | 67.21*                |
| Amylic Ether              | 69.40*                | Oil of Lemons      | 70.02*                |
| Valerianic Acid           | 103.52*               |                    |                       |

TABLE  
OF THE SPECIFIC HEAT OF BODIES IN THE SOLID, LIQUID, AND GASEOUS STATES.  
REGNAULT. — Mémoires de l'Académie de France, Tome XXVI, p. 327.

| Name.                   | Solid.              |           | Liquid.             |           | Gaseous.            |           |
|-------------------------|---------------------|-----------|---------------------|-----------|---------------------|-----------|
|                         | Temperature.<br>°C. | Sp. Heat. | Temperature.<br>°C. | Sp. Heat. | Temperature.<br>°C. | Sp. Heat. |
| Water                   | —78 to 0            | 0.4740    | 10                  | 1.0000    | 128 to 220          | 0.4805    |
| Bromine                 | —20 to 0            | 0.5040    | 10 to 100           | 1.0000    | 83 to 228           | 0.0555    |
| Alcohol                 | —77.8 to —25        | 0.0833    | — 7.3 to + 10       | 0.1060    |                     |           |
|                         |                     |           | + 13 to + 58        | 0.1129    |                     |           |
|                         |                     |           | — 20                | 0.5053    | 105 to 220          | 0.4534    |
|                         |                     |           | 0                   | 0.5475    |                     |           |
|                         |                     |           | + 20                | 0.5951    |                     |           |
| Ether                   |                     |           | 40                  | 0.6479    |                     |           |
|                         |                     |           | 60                  | 0.7060    |                     |           |
|                         |                     |           | 80                  | 0.7694    |                     |           |
|                         |                     |           | — 30                | 0.5113    | 70 to 220           | 0.4797    |
|                         |                     |           | 0                   | 0.5290    |                     |           |
| Bisulphide of Carbon    |                     |           | + 30                | 0.5467    |                     |           |
|                         |                     |           | 35                  | 0.5497    |                     |           |
|                         |                     |           | — 30                | 0.2303    | 73 to 192           | 0.1570    |
|                         |                     |           | 0                   | 0.2352    |                     |           |
|                         |                     |           | + 30                | 0.2401    |                     |           |
| Wood Spirits<br>Acetone |                     |           | 45                  | 0.2426    |                     |           |
|                         |                     |           | 0 to 20             | 0.6700    | 101 to 223          | 0.4580    |
|                         |                     |           | — 30                | 0.4824    | 129 to 233          | 0.4125    |
|                         |                     |           | 0                   | 0.5064    |                     |           |
|                         |                     |           | + 30                | 0.5302    |                     |           |
|                         |                     |           | 60                  | 0.5540    |                     |           |



|                            |                 |        |               |        |
|----------------------------|-----------------|--------|---------------|--------|
| Sulphide of Ethyl          | 20 to 70        | 0.4785 | 120 to 223    | 0.4008 |
| Chloride of Ethyl          | — 27.6 to + 4.5 | 0.4276 | 19 to 172     | 0.2738 |
| Bromide of Ethyl           | 0 to 20         | 0.2160 | 77.7 to 196.5 | 0.1896 |
| Cyanide of Ethyl           | — 30            | 0.4325 | 114 to 221    | 0.4262 |
|                            | 0               | 0.5086 |               |        |
|                            | + 30            | 0.5847 |               |        |
|                            | 60              | 0.6608 |               |        |
|                            | 90              | 0.7369 |               |        |
| Acetate of Ethyl           | — 30            | 0.4960 | 115 to 219    | 0.4008 |
|                            | 0               | 0.5274 |               |        |
|                            | + 30            | 0.5588 |               |        |
|                            | 60              | 0.5902 |               |        |
| Chloroform                 | — 30            | 0.2293 | 117 to 228    | 0.1567 |
|                            | 0               | 0.2324 |               |        |
|                            | + 30            | 0.2354 |               |        |
|                            | 60              | 0.2384 |               |        |
| Dutch Liquid               | — 30            | 0.2790 | 111 to 221    | 0.2293 |
|                            | 0               | 0.2922 |               |        |
|                            | + 30            | 0.3054 |               |        |
|                            | 60              | 0.3186 |               |        |
| Benzine                    | 20 to 71        | 0.4360 | 116 to 218    | 0.3754 |
| Turpentine                 | 0               | 0.4106 | 179 to 249    | 0.5061 |
|                            | 40              | 0.4538 |               |        |
|                            | 80              | 0.4842 |               |        |
|                            | 120             | 0.5019 |               |        |
|                            | 160             | 0.5068 |               |        |
| Chloride Silicon           | 0 to 20         | 0.1900 | 90 to 234     | 0.1322 |
| Perechloride of Phosphorus | 12 to 98        | 0.2092 | 112 to 246    | 0.1347 |
| Terechloride of Arsenic    | 14 to 98        | 0.1760 | 159 to 268    | 0.1122 |
| Bichloride of Tin          | 14 to 98        | 0.1475 | 149 to 273    | 0.0939 |
| Bichloride of Titanium     | 12 to 98        | 0.1880 | 162 to 272    | 0.1290 |

## TABLE

OF SPECIFIC HEATS OF THE MOST COMMON GASES AND VAPORS.

*The quantity of heat necessary to raise 1 gramme of water from 0° to 1° being unity.*

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. pp. 303, 313, 318.

| Name.                     | Equal Weights. | Equal Volumes. | Density. |
|---------------------------|----------------|----------------|----------|
| Oxygen                    | 0.21751        | 0.24049        | 1.10560  |
| Nitrogen                  | 0.24380        | 0.23680        | 0.97130  |
| Hydrogen                  | 3.40900        | 0.23590        | 0.06920  |
| Chlorine                  | 0.12099        | 0.29645        | 2.45020  |
| Bromine vapor             | 0.05552        | 0.30400        | 5.47720  |
| Deutoxide of Nitrogen     | 0.23170        | 0.24060        | 1.03840  |
| Carbonic oxide            | 0.24500        | 0.23700        | 0.96730  |
| Hydrochloric Acid         | 0.18520        | 0.23330        | 1.25960  |
| Carbonic Acid             | 0.21690        | 0.33070        | 1.52010  |
| Protoxide of Nitrogen     | 0.22620        | 0.34470        | 1.52410  |
| Vapor of Water            | 0.48050        | 0.29890        | 0.62190  |
| Sulphurous Acid           | 0.15440        | 0.34140        | 2.21130  |
| Hydrosulphuric Acid       | 0.24320        | 0.28570        | 1.17470  |
| Bisulphide of Carbon      | 0.15690        | 0.41220        | 2.62580  |
| Protocarburetted Hydrogen | 0.59290        | 0.32770        | 0.55270  |
| Chloroform                | 0.15670        | 0.64610        | 4.12440  |
| Bicarburetted Hydrogen    | 0.40400        | 0.41600        | 0.96720  |
| Ammonia                   | 0.50840        | 0.29960        | 0.58940  |
| Benzine                   | 0.37540        | 1.01140        | 2.69420  |
| Essence of Turpentine     | 0.50610        | 2.37760        | 4.69780  |
| Wood Spirit               | 0.45800        | 0.50630        | 1.10550  |
| Ether                     | 0.47970        | 1.22660        | 2.55730  |
| Sulphide of Ethyl         | 0.40080        | 1.24660        | 3.11010  |
| Chloride “                | 0.27380        | 0.60960        | 2.22690  |
| Bromide “                 | 0.18960        | 0.70260        | 3.70580  |
| Dutch liquid              | 0.22930        | 0.78360        | 3.41740  |
| Acetone                   | 0.41250        | 0.82640        | 2.00360  |
| Acetate of Ethyl          | 0.40080        | 1.21840        | 3.04000  |
| Chloride of Silicium      | 0.13220        | 0.77780        | 5.88330  |
| Terchloride of Phosphorus | 0.13470        | 0.63950        | 4.74640  |
| “ Arsenic                 | 0.11220        | 0.70340        | 6.26670  |
| Bichloride of Titanium    | 0.12900        | 0.85640        | 6.64020  |
| “ Tin                     | 0.09390        | 0.84160        | 8.96540  |

## SPECIFIC HEAT OF WATER AND LATENT HEAT OF THE VAPOR OF WATER.

REGNAULT. — Mémoires de l'Académie de France, Tome XXI. p. 748.

| Temperature measured by the Air Thermometer.<br>$T^{\circ}$ . | Number of units of Heat lost by one Kilogramme of Water in passing from $T^{\circ}$ to $0^{\circ}$ .<br>$Q$ . | Mean Specific Heat of Water between $0^{\circ}$ and $T^{\circ}$ . | Specific Heat of Water from $T^{\circ}$ to $T^{\circ} + dT^{\circ}$<br>$\frac{dQ}{dT}$ | Latent Heat of the saturated Vapor at the Temperature $T^{\circ}$ . | Total Heat. |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------|
| 0                                                             | 0.000                                                                                                         | 0.0000                                                            | 1.0000                                                                                 | 606.5                                                               | 0.0         |
| 10                                                            | 10.002                                                                                                        | 1.0002                                                            | 1.0005                                                                                 | 599.5                                                               | 609.5       |
| 20                                                            | 20.010                                                                                                        | 1.0005                                                            | 1.0012                                                                                 | 592.6                                                               | 612.6       |
| 30                                                            | 30.026                                                                                                        | 1.0009                                                            | 1.0020                                                                                 | 585.7                                                               | 615.7       |
| 40                                                            | 40.051                                                                                                        | 1.0013                                                            | 1.0030                                                                                 | 578.7                                                               | 618.7       |
| 50                                                            | 50.087                                                                                                        | 1.0017                                                            | 1.0042                                                                                 | 571.6                                                               | 621.7       |
| 60                                                            | 60.137                                                                                                        | 1.0023                                                            | 1.0056                                                                                 | 564.7                                                               | 624.8       |
| 70                                                            | 70.210                                                                                                        | 1.0030                                                            | 1.0072                                                                                 | 557.6                                                               | 627.8       |
| 80                                                            | 80.282                                                                                                        | 1.0035                                                            | 1.0089                                                                                 | 550.6                                                               | 630.9       |
| 90                                                            | 90.381                                                                                                        | 1.0042                                                            | 1.0109                                                                                 | 543.5                                                               | 633.9       |
| 100                                                           | 100.500                                                                                                       | 1.0050                                                            | 1.0130                                                                                 | 536.5                                                               | 637.0       |
| 110                                                           | 110.641                                                                                                       | 1.0058                                                            | 1.0153                                                                                 | 529.4                                                               | 640.0       |
| 120                                                           | 120.806                                                                                                       | 1.0067                                                            | 1.0177                                                                                 | 522.3                                                               | 643.1       |
| 130                                                           | 130.997                                                                                                       | 1.0076                                                            | 1.0204                                                                                 | 515.1                                                               | 646.1       |
| 140                                                           | 141.215                                                                                                       | 1.0087                                                            | 1.0232                                                                                 | 508.0                                                               | 649.2       |
| 150                                                           | 151.462                                                                                                       | 1.0097                                                            | 1.0262                                                                                 | 500.7                                                               | 652.2       |
| 160                                                           | 161.741                                                                                                       | 1.0109                                                            | 1.0294                                                                                 | 493.6                                                               | 655.3       |
| 170                                                           | 172.052                                                                                                       | 1.0121                                                            | 1.0328                                                                                 | 486.2                                                               | 658.3       |
| 180                                                           | 182.398                                                                                                       | 1.0133                                                            | 1.0364                                                                                 | 479.0                                                               | 661.4       |
| 190                                                           | 192.779                                                                                                       | 1.0146                                                            | 1.0401                                                                                 | 471.6                                                               | 664.4       |
| 200                                                           | 203.200                                                                                                       | 1.0160                                                            | 1.0440                                                                                 | 464.3                                                               | 667.5       |
| 210                                                           | 213.660                                                                                                       | 1.0174                                                            | 1.0481                                                                                 | 456.8                                                               | 670.5       |
| 220                                                           | 224.162                                                                                                       | 1.0189                                                            | 1.0524                                                                                 | 449.4                                                               | 673.6       |
| 230                                                           | 234.708                                                                                                       | 1.0204                                                            | 1.0568                                                                                 | 441.9                                                               | 676.6       |

## TOTAL HEAT OF VAPORIZATION OF DIFFERENT LIQUIDS.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 913.

| Substance.                | $^{\circ}\text{C}$ . | Substance.                            | $^{\circ}\text{C}$ . |
|---------------------------|----------------------|---------------------------------------|----------------------|
| Amylic Alcohol            | 211.78               | Acetate of Ethyl                      | 154.49               |
| Turpentine                | 139.15               | Bisulphide of Carbon                  | 96.80                |
| Essence of Citron         | 160.49               | Alcohol                               | 265.50               |
| Petroleum                 | 194.87               | Ether                                 | 109.12               |
| Chloride of Ethyl         | 97.70                | Benzine                               | 127.40               |
| Iodide of Ethyl           | 58.95                | Chloroform                            | 76.33                |
| Bromine                   | 50.95                | Chloride of Carbon ( $\text{CCl}_2$ ) | 62.30                |
| Bichloride of tin         | 46.84                | Acetone                               | 153.65               |
| Terchloride of Arsenic    | 69.74                | Water                                 | 636.70               |
| Terchloride of Phosphorus | 67.24                |                                       |                      |

## TABLE

OF THE LINEAR EXPANSION OF VARIOUS SOLID BODIES BETWEEN  
0° AND 100° C.

| Substance.              | Expansion. | Observer.              |
|-------------------------|------------|------------------------|
| Lead                    | 0.00284836 | Lavoisier.             |
| "                       | 0.00271900 | Guyton de Morveau.     |
| "                       | 0.00286667 | Smeaton.               |
| "                       | 0.00300500 | Calvert and Johnson.   |
| Iron, Wrought           | 0.00122045 | Lavoisier and Laplace. |
| " "                     | 0.00118203 | Dulong and Petit.      |
| " "                     | 0.00125833 | Smeaton.               |
| " "                     | 0.00118700 | Calvert and Johnson.   |
| Iron, Wire              | 0.00123504 | Lavoisier.             |
| " "                     | 0.00114010 | Borda.                 |
| Iron, Cast              | 0.00111700 | Calvert and Johnson.   |
| " "                     | 0.00110940 | Roy.                   |
| Glass, English flint    | 0.00081166 | Lavoisier.             |
| " French "              | 0.00087199 | "                      |
| " Soft                  | 0.00086100 | Dulong and Petit.      |
| " "                     | 0.00083333 | Smeaton.               |
| " Tube                  | 0.00077615 | Roy.                   |
| " " free from Lead      | 0.00087572 | Lavoisier.             |
| " " " "                 | 0.00091751 | "                      |
| " Rod                   | 0.00080787 | Roy.                   |
| Gold, Fine              | 0.00146606 | Lavoisier.             |
| " Paris test unannealed | 0.00155155 | "                      |
| " " " annealed          | 0.00151361 | "                      |
| "                       | 0.00147500 | Guyton de Morveau.     |
| "                       | 0.00140100 | Ellicot.               |
| "                       | 0.00137400 | Calvert and Johnson.   |
| Copper                  | 0.00171000 | Ellicot.               |
| " Hammered              | 0.00172244 | Lavoisier.             |
| " "                     | 0.00176900 | Calvert and Johnson.   |
| "                       | 0.00171222 | Lavoisier.             |
| "                       | 0.00171822 | Dulong and Petit.      |
| " Cast                  | 0.00187900 | Calvert and Johnson.   |
| Brass                   | 0.00193332 | Smeaton.               |

| Substance.                  | Expansion. | Observer.            |
|-----------------------------|------------|----------------------|
| Brass Wire                  | 0.00187821 | Lavoisier.           |
| “ “                         | 0.00188500 | Herbert.             |
| “ Hammered                  | 0.00182800 | Calvert and Johnson. |
| “ Cast                      | 0.00186671 | Lavoisier.           |
| “ “                         | 0.00193000 | Calvert and Johnson. |
| “                           | 0.00187500 | Smeaton.             |
| Palladium                   | 0.00100000 | Wollaston.           |
| Platinum                    | 0.00088417 | Dulong and Petit.    |
| “                           | 0.00090000 | Wollaston.           |
| “                           | 0.00085700 | Guyton de Morveau.   |
| “                           | 0.00088100 | Calvert and Johnson. |
| Silver, Cupeled             | 0.00190974 | Lavoisier.           |
| “                           | 0.00198800 | Guyton de Morveau.   |
| “                           | 0.00208260 | Troughton.           |
| “ Cast                      | 0.00199100 | Calvert and Johnson. |
| Steel, Soft                 | 0.00107875 | Lavoisier.           |
| “ “                         | 0.00115000 | Smeaton.             |
| “ “                         | 0.00103800 | Calvert and Johnson. |
| “ Tempered                  | 0.00140200 | “ “                  |
| “ “                         | 0.00136900 | Lavoisier.           |
| “ Rod                       | 0.00114470 | Roy.                 |
| Bismuth                     | 0.00139167 | Smeaton.             |
| “                           | 0.00134100 | Calvert and Johnson. |
| Zinc, Cast                  | 0.00294167 | Smeaton.             |
| “ “                         | 0.00305100 | Guyton de Morveau.   |
| “ Hammered                  | 0.00310833 | Smeaton.             |
| “ “                         | 0.00219300 | Calvert and Johnson. |
| Tin, Fine                   | 0.00216400 | Guyton de Morveau.   |
| “                           | 0.00209300 | Herbert.             |
| “                           | 0.00271700 | Calvert and Johnson. |
| “ Malacca                   | 0.00193765 | Lavoisier.           |
| “ Common                    | 0.00248330 | Smeaton.             |
| Bronze                      | 0.00181667 | “                    |
| Alloy 1 Zn 2 Cu             | 0.00205833 | “                    |
| Calc-spar in the Chief Axis | 0.00286000 | Mitscherlich.        |
| Coal from Oak Wood          | 0.00120000 | P. Henrich.          |
| “ “ Fir “                   | 0.00100000 | “                    |
| Marble from Carrara         | 0.00084870 | Destigny.            |
| “ “ St. Beat                | 0.00041810 | “                    |
| Phosphorus from 0 – 39.50°  | 0.00142455 | Erman.               |
| Aluminum                    | 0.00221800 | Calvert and Johnson. |
| Cadmium                     | 0.00332300 | “ “                  |
| Antimony, Hammered          | 0.00098500 | “ “                  |
| Speculum Metal              | 0.00193333 | Smeaton.             |
| Antimony                    | 0.00108330 | “                    |
| Solder, Soft                | 0.00250533 | “                    |



## TABLE

OF THE CUBICAL EXPANSION OF DIFFERENT SOLID BODIES FOR EACH  
INCREASE OF 1° C. OF TEMPERATURE.

KOPP. — Annalen der Chemie und Pharmacie, LXXXI. 65.

| Name of Substance.                            | Formula.                                                                       | Coefficient of Expansion. |
|-----------------------------------------------|--------------------------------------------------------------------------------|---------------------------|
| Antimony                                      | Sb                                                                             | 0.000033                  |
| Bismuth                                       | Bi                                                                             | 0.000040                  |
| Cadmium                                       | Cd                                                                             | 0.000094                  |
| Copper                                        | Cu                                                                             | 0.000051                  |
| Iron                                          | Fe                                                                             | 0.000037                  |
| Lead                                          | Pb                                                                             | 0.000089                  |
| Sulphur                                       | S                                                                              | 0.000183                  |
| Tin                                           | Sn                                                                             | 0.000069                  |
| Zinc                                          | Zn                                                                             | 0.000089                  |
| Barium, Sulphate                              | BaO, SO <sub>3</sub>                                                           | 0.000058                  |
| Arragonite                                    | CaO, CO <sub>2</sub>                                                           | 0.000065                  |
| Dolomite                                      | CaO, CO <sub>2</sub> + MgO, CO <sub>2</sub>                                    | 0.000035                  |
| Strontium, Sulphate                           | SrO, SO <sub>3</sub>                                                           | 0.000061                  |
| Specular Iron Ore                             | Fe <sub>2</sub> O <sub>3</sub>                                                 | 0.000040                  |
| Iron Pyrites                                  | FeS <sub>2</sub>                                                               | 0.000034                  |
| Carbonate of Iron, Manganese,<br>and Magnesia | Fe(Mg, Mn)O, CO <sub>2</sub>                                                   | 0.000035                  |
| Fluor Spar                                    | CaF                                                                            | 0.000062                  |
| Carbonate of Lime, Calc-spar                  | CaO, CO <sub>2</sub>                                                           | 0.000018                  |
| Magnetic Iron Ore                             | Fe <sub>3</sub> O <sub>4</sub>                                                 | 0.000029                  |
| Orthoclase                                    | { KO, SiO <sub>2</sub> +<br>Al <sub>2</sub> O <sub>3</sub> , 3SiO <sub>2</sub> | 0.000026<br>0.000017      |
| Quartz                                        | SiO <sub>2</sub>                                                               | { 0.000042<br>0.000039    |
| Rutile                                        | TiO <sub>2</sub>                                                               | 0.000032                  |
| Tin Stone                                     | SnO <sub>2</sub>                                                               | 0.000016                  |
| Zinc Blende                                   | ZnS                                                                            | 0.000036                  |
| Hard Potash Glass                             |                                                                                | 0.000021                  |
| Soft Soda Glass                               |                                                                                | 0.000026                  |
| “ “ “ another kind                            |                                                                                | 0.000024                  |
| Galena                                        | PbS                                                                            | 0.000068                  |



## TABLE

OF THE VOLUME OF A GLASS VESSEL WHEN ITS VOLUME AT 15° C.  
IS TAKEN AS UNITY.

GERLACH'S Salzlösungen, p. 115.

| VOLUME AT |            |     |            |
|-----------|------------|-----|------------|
| °C.       |            | °C. |            |
| 0         | 0.99961210 | 23  | 1.00020688 |
| 1         | 0.99963796 | 24  | 1.00023274 |
| 2         | 0.99966382 | 25  | 1.00025860 |
| 3         | 0.99968968 | 26  | 1.00028446 |
| 4         | 0.99971554 | 27  | 1.00031032 |
| 5         | 0.99974140 | 28  | 1.00033618 |
| 6         | 0.99976726 | 29  | 1.00036204 |
| 7         | 0.99979313 | 30  | 1.00038790 |
| 8         | 0.99981898 | 35  | 1.00051720 |
| 9         | 0.99984484 | 40  | 1.00064650 |
| 10        | 0.99987070 | 45  | 1.00077580 |
| 11        | 0.99989656 | 50  | 1.00090510 |
| 12        | 0.99992242 | 55  | 1.00103440 |
| 13        | 0.99994828 | 60  | 1.00116370 |
| 14        | 0.99997414 | 65  | 1.00129300 |
| 15        | 1.00000000 | 70  | 1.00142230 |
| 16        | 1.00002586 | 75  | 1.00155160 |
| 17        | 1.00005172 | 80  | 1.00168090 |
| 18        | 1.00007758 | 85  | 1.00181020 |
| 19        | 1.00010344 | 90  | 1.00193950 |
| 20        | 1.00012930 | 95  | 1.00206880 |
| 21        | 1.00015516 | 100 | 1.00219810 |
| 22        | 1.00018102 |     |            |

## TABLE

OF THE EXPANSION OF GLASS.

*Calculated from Regnault's data.*JAS T. BROWN.—*Jour. Chem. Society, N. S. IV. p. 80.*

| $t' - t$ | $1 + k(t' - t)$ | $t' - t$ | $1 + k(t' - t)$ | $t' - t$ | $1 + k(t' - t)$ |
|----------|-----------------|----------|-----------------|----------|-----------------|
| 35       | 1.00096         | 145      | 1.00421         | 250      | 1.00765         |
| 40       | 1.00110         | 150      | 1.00436         | 255      | 1.00780         |
| 45       | 1.00124         | 155      | 1.00451         | 260      | 1.00795         |
| 50       | 1.00138         | 160      | 1.00465         | 265      | 1.00810         |
| 55       | 1.00151         | 165      | 1.00480         | 270      | 1.00826         |
| 60       | 1.00165         | 170      | 1.00494         | 275      | 1.00841         |
| 65       | 1.00179         | 175      | 1.00509         | 280      | 1.00856         |
| 70       | 1.00193         | 180      | 1.00523         | 285      | 1.00892         |
| 75       | 1.00207         | 185      | 1.00551         | 290      | 1.00907         |
| 80       | 1.00220         | 190      | 1.00566         | 295      | 1.00923         |
| 85       | 1.00241         | 195      | 1.00581         | 300      | 1.00939         |
| 90       | 1.00255         | 200      | 1.00596         | 305      | 1.00954         |
| 95       | 1.00269         | 205      | 1.00610         | 310      | 1.00970         |
| 100      | 1.00284         | 210      | 1.00625         | 315      | 1.00985         |
| 105      | 1.00298         | 215      | 1.00640         | 320      | 1.01001         |
| 110      | 1.00312         | 220      | 1.00655         | 325      | 1.01017         |
| 115      | 1.00326         | 225      | 1.00670         | 330      | 1.01032         |
| 120      | 1.00340         | 230      | 1.00685         | 335      | 1.01048         |
| 125      | 1.00355         | 235      | 1.00719         | 340      | 1.01064         |
| 130      | 1.00369         | 240      | 1.00734         | 345      | 1.01079         |
| 135      | 1.00392         | 245      | 1.00749         | 350      | 1.01095         |
| 140      | 1.00407         |          |                 |          |                 |

## TABLE

## OF THE ABSOLUTE DILATATION OF MERCURY.

REGNAULT. — Mémoires de l'Académie de France, Tome XXI. p. 323.

| Tempera-<br>ture by<br>Air Ther-<br>mometer.<br>T. | Dilatation of<br>Mercury from<br>0° to T.<br>$\delta_r$ | Mean Coefficient<br>of Dilatation from<br>0° to T.<br>$\delta$ | Real Coefficient<br>of Dilatation at T.<br>$\frac{d \delta_r}{d T}$ | Temperature<br>deduced from<br>the absolute<br>Dilatation of<br>Mercury.<br>$\theta$ | Difference<br>between<br>Thermome-<br>ter based on<br>the absolute<br>Dilatation of<br>Mercury and<br>the Air Ther-<br>mometer.<br>( $\theta - T.$ ) |
|----------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                                                  | 0.000000                                                | 0.00000000                                                     | 0.00017905                                                          | 0.000                                                                                | 0.000                                                                                                                                                |
| 10                                                 | 0.001792                                                | 0.00017925                                                     | 0.00017950                                                          | 9.872                                                                                | -0.128                                                                                                                                               |
| 20                                                 | 0.003590                                                | 0.00017951                                                     | 0.00018001                                                          | 19.776                                                                               | -0.224                                                                                                                                               |
| 30                                                 | 0.005393                                                | 0.00017976                                                     | 0.00018051                                                          | 29.709                                                                               | -0.291                                                                                                                                               |
| 40                                                 | 0.007201                                                | 0.00018002                                                     | 0.00018102                                                          | 39.668                                                                               | -0.332                                                                                                                                               |
| 50                                                 | 0.009013                                                | 0.00018027                                                     | 0.00018152                                                          | 49.650                                                                               | -0.350                                                                                                                                               |
| 60                                                 | 0.010831                                                | 0.00018052                                                     | 0.00018203                                                          | 59.665                                                                               | -0.335                                                                                                                                               |
| 70                                                 | 0.012655                                                | 0.00018078                                                     | 0.00018253                                                          | 69.713                                                                               | -0.287                                                                                                                                               |
| 80                                                 | 0.014482                                                | 0.00018102                                                     | 0.00018304                                                          | 79.777                                                                               | -0.223                                                                                                                                               |
| 90                                                 | 0.016315                                                | 0.00018128                                                     | 0.00018354                                                          | 89.875                                                                               | -0.125                                                                                                                                               |
| 100                                                | 0.018153                                                | 0.00018153                                                     | 0.00018405                                                          | 100.000                                                                              | 0.000                                                                                                                                                |
| 110                                                | 0.019996                                                | 0.00018178                                                     | 0.00018455                                                          | 110.153                                                                              | +0.153                                                                                                                                               |
| 120                                                | 0.021844                                                | 0.00018203                                                     | 0.00018505                                                          | 120.333                                                                              | 0.333                                                                                                                                                |
| 130                                                | 0.023697                                                | 0.00018228                                                     | 0.00018556                                                          | 130.540                                                                              | 0.540                                                                                                                                                |
| 140                                                | 0.025555                                                | 0.00018254                                                     | 0.00018606                                                          | 140.776                                                                              | 0.776                                                                                                                                                |
| 150                                                | 0.027419                                                | 0.00018279                                                     | 0.00018657                                                          | 151.044                                                                              | 1.044                                                                                                                                                |
| 160                                                | 0.029287                                                | 0.00018304                                                     | 0.00018707                                                          | 161.334                                                                              | 1.334                                                                                                                                                |
| 170                                                | 0.031160                                                | 0.00018329                                                     | 0.00018758                                                          | 171.652                                                                              | 1.652                                                                                                                                                |
| 180                                                | 0.033039                                                | 0.00018355                                                     | 0.00018808                                                          | 182.003                                                                              | 2.003                                                                                                                                                |
| 190                                                | 0.034922                                                | 0.00018380                                                     | 0.00018859                                                          | 192.376                                                                              | 2.376                                                                                                                                                |
| 200                                                | 0.036811                                                | 0.00018405                                                     | 0.00018909                                                          | 202.782                                                                              | 2.782                                                                                                                                                |
| 210                                                | 0.038704                                                | 0.00018430                                                     | 0.00018959                                                          | 213.210                                                                              | 3.210                                                                                                                                                |
| 220                                                | 0.040603                                                | 0.00018456                                                     | 0.00019010                                                          | 223.671                                                                              | 3.671                                                                                                                                                |
| 230                                                | 0.042506                                                | 0.00018481                                                     | 0.00019061                                                          | 234.154                                                                              | 4.154                                                                                                                                                |
| 240                                                | 0.044415                                                | 0.00018506                                                     | 0.00019111                                                          | 244.670                                                                              | 4.670                                                                                                                                                |
| 250                                                | 0.046329                                                | 0.00018531                                                     | 0.00019161                                                          | 255.214                                                                              | 5.214                                                                                                                                                |
| 260                                                | 0.048247                                                | 0.00018557                                                     | 0.00019212                                                          | 265.780                                                                              | 5.780                                                                                                                                                |
| 270                                                | 0.050171                                                | 0.00018582                                                     | 0.00019262                                                          | 276.379                                                                              | 6.379                                                                                                                                                |
| 280                                                | 0.052100                                                | 0.00018607                                                     | 0.00019313                                                          | 287.005                                                                              | 7.005                                                                                                                                                |
| 290                                                | 0.054034                                                | 0.00018632                                                     | 0.00019363                                                          | 297.659                                                                              | 7.659                                                                                                                                                |
| 300                                                | 0.055973                                                | 0.00018658                                                     | 0.00019413                                                          | 308.340                                                                              | 8.340                                                                                                                                                |
| 310                                                | 0.057917                                                | 0.00018683                                                     | 0.00019464                                                          | 319.048                                                                              | 9.048                                                                                                                                                |
| 320                                                | 0.059866                                                | 0.00018708                                                     | 0.00019515                                                          | 329.786                                                                              | 9.786                                                                                                                                                |
| 330                                                | 0.061820                                                | 0.00018733                                                     | 0.00019565                                                          | 340.550                                                                              | 10.550                                                                                                                                               |
| 340                                                | 0.063778                                                | 0.00018758                                                     | 0.00019616                                                          | 351.336                                                                              | 11.336                                                                                                                                               |
| 350                                                | 0.065743                                                | 0.00018784                                                     | 0.00019666                                                          | 362.160                                                                              | 12.160                                                                                                                                               |

## TABLE

COMPARING AIR AND MERCURY THERMOMETERS MADE OF DIFFERENT KINDS OF GLASS.

REGNAULT. — Mémoires de l'Académie de France, Tome XXI. p. 239.

| Temperature<br>of Air Ther-<br>mometer. | Temperatures of Mercurial Thermometers. |               |              |                        |
|-----------------------------------------|-----------------------------------------|---------------|--------------|------------------------|
|                                         | Crystal from<br>Choisy-le-Roi.          | Common Glass. | Green Glass. | Hard Swedish<br>Glass. |
| 100 <sup>o</sup>                        | 100.00                                  | 100.00        | 100.00       | 100.00                 |
| 110                                     | 110.05                                  | 109.98        | 110.03       | 110.02                 |
| 120                                     | 120.12                                  | 119.95        | 120.08       | 120.04                 |
| 130                                     | 130.20                                  | 129.91        | 130.14       | 130.07                 |
| 140                                     | 140.29                                  | 139.85        | 140.21       | 140.11                 |
| 150                                     | 150.40                                  | 149.80        | 150.30       | 150.15                 |
| 160                                     | 160.52                                  | 159.74        | 160.40       | 160.20                 |
| 170                                     | 170.65                                  | 169.68        | 170.50       | 170.26                 |
| 180                                     | 180.80                                  | 179.63        | 180.60       | 180.33                 |
| 190                                     | 191.01                                  | 189.65        | 190.70       | 190.41                 |
| 200                                     | 201.25                                  | 199.70        | 200.80       | 200.50                 |
| 210                                     | 211.53                                  | 209.75        | 211.00       | 210.61                 |
| 220                                     | 221.82                                  | 219.80        | 221.20       | 220.75                 |
| 230                                     | 232.16                                  | 229.85        | 231.42       | 230.91                 |
| 240                                     | 242.55                                  | 239.90        | 241.60       | 241.16                 |
| 250                                     | 253.00                                  | 250.05        | 251.85       | 251.44                 |
| 260                                     | 263.44                                  | 260.20        | 262.15       |                        |
| 270                                     | 273.90                                  | 270.38        | 272.50       |                        |
| 280                                     | 284.48                                  | 280.52        | 282.85       |                        |
| 290                                     | 295.10                                  | 290.80        | 293.30       |                        |
| 300                                     | 305.72                                  | 301.08        |              |                        |
| 310                                     | 316.45                                  | 311.45        |              |                        |
| 320                                     | 327.25                                  | 321.80        |              |                        |
| 330                                     | 338.22                                  | 332.40        |              |                        |
| 340                                     | 349.30                                  | 343.00        |              |                        |
| 350                                     | 360.50                                  | 354.00        |              |                        |

TABLE

FOR COMPARISON OF CENTIGRADE AND FAHRENHEIT THERMOMETER  
SCALES.

| Centi-<br>grade. | Fahrenheit. | Centi-<br>grade. | Fahrenheit. | Centi-<br>grade. | Fahrenheit. | Centi-<br>grade. | Fahrenheit. |
|------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|
| +100             | +212.0      | +64              | +147.2      | +29              | +84.2       | — 6              | +21.2       |
| 99               | 210.2       | 63               | 145.4       | 28               | 82.4        | 7                | 19.4        |
| 98               | 208.4       | 62               | 143.6       | 27               | 80.6        | 8                | 17.6        |
| 97               | 206.6       | 61               | 141.8       | 26               | 78.8        | 9                | 15.8        |
| 96               | 204.8       | 60               | 140.0       | 25               | 77.0        | 10               | 14.0        |
| 95               | 203.0       | 59               | 138.2       | 24               | 75.2        | 11               | 12.2        |
| 94               | 201.2       | 58               | 136.4       | 23               | 73.4        | 12               | 10.4        |
| 93               | 199.4       | 57               | 134.6       | 22               | 71.6        | 13               | 8.6         |
| 92               | 197.6       | 56               | 132.8       | 21               | 69.8        | 14               | 6.8         |
| 91               | 195.8       | 55               | 131.0       | 20               | 68.0        | 15               | 5.0         |
| 90               | 194.0       | 54               | 129.2       | 19               | 66.2        | 16               | 3.2         |
| 89               | 192.2       | 53               | 127.4       | 18               | 64.4        | 17               | + 1.4       |
| 88               | 190.4       | 52               | 125.6       | 17               | 62.6        | 18               | — 0.4       |
| 87               | 188.6       | 51               | 123.8       | 16               | 60.8        | 19               | 2.2         |
| 86               | 186.8       | 50               | 122.0       | 15               | 59.0        | 20               | 4.0         |
| 85               | 185.0       | 49               | 120.2       | 14               | 57.2        | 21               | 5.8         |
| 84               | 183.2       | 48               | 118.4       | 13               | 55.4        | 22               | 7.6         |
| 83               | 181.4       | 47               | 116.6       | 12               | 53.6        | 23               | 9.4         |
| 82               | 179.6       | 46               | 114.8       | 11               | 51.8        | 24               | 11.2        |
| 81               | 177.8       | 45               | 113.0       | 10               | 50.0        | 25               | 13.0        |
| 80               | 176.0       | 44               | 111.2       | 9                | 48.2        | 26               | 14.8        |
| 79               | 174.2       | 43               | 109.4       | 8                | 46.4        | 27               | 16.6        |
| 78               | 172.4       | 42               | 107.6       | 7                | 44.6        | 28               | 18.4        |
| 77               | 170.6       | 41               | 105.8       | 6                | 42.8        | 29               | 20.2        |
| 76               | 168.8       | 40               | 104.0       | 5                | 41.0        | 30               | 22.0        |
| 75               | 167.0       | 39               | 102.2       | 4                | 39.2        | 31               | 23.8        |
| 74               | 165.2       | 38               | 100.4       | 3                | 37.4        | 32               | 25.6        |
| 73               | 163.4       | 37               | 98.6        | 2                | 35.6        | 33               | 27.4        |
| 72               | 161.6       | 36               | 96.8        | + 1              | 33.8        | 34               | 29.2        |
| 71               | 159.8       | 35               | 95.0        | 0                | 32.0        | 35               | 31.0        |
| 70               | 158.0       | 34               | 93.2        | — 1              | 30.2        | 36               | 32.8        |
| 69               | 156.2       | 33               | 91.4        | 2                | 28.4        | 37               | 34.6        |
| 68               | 154.4       | 32               | 89.6        | 3                | 26.6        | 38               | 36.4        |
| 67               | 152.6       | 31               | 87.8        | 4                | 24.8        | 39               | 38.2        |
| 66               | 150.8       | +30              | + 86.0      | — 5              | +23.0       | —40              | —40.0       |
| +65              | +149.0      |                  |             |                  |             |                  |             |



TABLE  
FOR THE COMPARISON OF THE FAHRENHEIT AND CENTIGRADE  
THERMOMETER SCALES.

| Fahrenheit. | Centigrade. | Fahrenheit. | Centigrade. | Fahrenheit. | Centigrade. |
|-------------|-------------|-------------|-------------|-------------|-------------|
| +212        | +100.00     | +174        | +78.89      | +136        | +57.78      |
| 211         | 99.44       | 173         | 78.33       | 135         | 57.22       |
| 210         | 98.89       | 172         | 77.78       | 134         | 56.67       |
| 209         | 98.33       | 171         | 77.22       | 133         | 56.11       |
| 208         | 97.78       | 170         | 76.67       | 132         | 55.55       |
| 207         | 97.22       | 169         | 76.11       | 131         | 55.00       |
| 206         | 96.67       | 168         | 75.55       | 130         | 54.44       |
| 205         | 96.11       | 167         | 75.00       | 129         | 53.89       |
| 204         | 95.55       | 166         | 74.44       | 128         | 53.33       |
| 203         | 95.00       | 165         | 73.89       | 127         | 52.78       |
| 202         | 94.44       | 164         | 73.33       | 126         | 52.22       |
| 201         | 93.89       | 163         | 72.78       | 125         | 51.67       |
| 200         | 93.33       | 162         | 72.22       | 124         | 51.11       |
| 199         | 92.78       | 161         | 71.67       | 123         | 50.55       |
| 198         | 92.22       | 160         | 71.11       | 122         | 50.00       |
| 197         | 91.67       | 159         | 70.55       | 121         | 49.44       |
| 196         | 91.11       | 158         | 70.00       | 120         | 48.89       |
| 195         | 90.55       | 157         | 69.44       | 119         | 48.33       |
| 194         | 90.00       | 156         | 68.89       | 118         | 47.78       |
| 193         | 89.44       | 155         | 68.33       | 117         | 47.22       |
| 192         | 88.89       | 154         | 67.78       | 116         | 46.67       |
| 191         | 88.33       | 153         | 67.22       | 115         | 46.11       |
| 190         | 87.78       | 152         | 66.67       | 114         | 45.55       |
| 189         | 87.22       | 151         | 66.11       | 113         | 45.00       |
| 188         | 86.67       | 150         | 65.55       | 112         | 44.44       |
| 187         | 86.11       | 149         | 65.00       | 111         | 43.89       |
| 186         | 85.55       | 148         | 64.44       | 110         | 43.33       |
| 185         | 85.00       | 147         | 63.89       | 109         | 42.78       |
| 184         | 84.44       | 146         | 63.33       | 108         | 42.22       |
| 183         | 83.89       | 145         | 62.78       | 107         | 41.67       |
| 182         | 83.33       | 144         | 62.22       | 106         | 41.11       |
| 181         | 82.78       | 143         | 61.67       | 105         | 40.55       |
| 180         | 82.22       | 142         | 61.11       | 104         | 40.00       |
| 179         | 81.67       | 141         | 60.55       | 103         | 39.44       |
| 178         | 81.11       | 140         | 60.00       | 102         | 38.89       |
| 177         | 80.55       | 139         | 59.44       | 101         | 38.33       |
| 176         | 80.00       | 138         | 58.89       | 100         | 37.78       |
| +175        | + 79.44     | +137        | +58.33      | + 99        | +37.22      |



| Fahrenheit. | Centigrade. | Fahrenheit. | Centigrade. | Fahrenheit. | Centigrade. |
|-------------|-------------|-------------|-------------|-------------|-------------|
| +98         | +36.67      | +51         | +10.55      | + 5         | -15.00      |
| 97          | 36.11       | 50          | 10.00       | 4           | 15.55       |
| 96          | 35.55       | 49          | 9.44        | 3           | 16.11       |
| 95          | 35.00       | 48          | 8.89        | 2           | 16.67       |
| 94          | 34.44       | 47          | 8.33        | + 1         | 17.22       |
| 93          | 33.89       | 46          | 7.78        | 0           | 17.78       |
| 92          | 33.33       | 45          | 7.22        | - 1         | 18.33       |
| 91          | 32.78       | 44          | 6.67        | 2           | 18.89       |
| 90          | 32.22       | 43          | 6.11        | 3           | 19.44       |
| 89          | 31.67       | 42          | 5.55        | 4           | 20.00       |
| 88          | 31.11       | 41          | 5.00        | 5           | 20.55       |
| 87          | 30.55       | 40          | 4.44        | 6           | 21.11       |
| 86          | 30.00       | 39          | 3.89        | 7           | 21.67       |
| 85          | 29.44       | 38          | 3.33        | 8           | 22.22       |
| 84          | 28.89       | 37          | 2.78        | 9           | 22.78       |
| 83          | 28.33       | 36          | 2.22        | 10          | 23.33       |
| 82          | 27.78       | 35          | 1.67        | 11          | 23.89       |
| 81          | 27.22       | 34          | 1.11        | 12          | 24.44       |
| 80          | 26.67       | 33          | + 0.55      | 13          | 25.00       |
| 79          | 26.11       | 32          | 0.00        | 14          | 25.55       |
| 78          | 25.55       | 31          | - 0.55      | 15          | 26.11       |
| 77          | 25.00       | 30          | 1.11        | 16          | 26.67       |
| 76          | 24.44       | 29          | 1.67        | 17          | 27.22       |
| 75          | 23.89       | 28          | 2.22        | 18          | 27.78       |
| 74          | 23.33       | 27          | 2.78        | 19          | 28.33       |
| 73          | 22.78       | 26          | 3.33        | 20          | 28.89       |
| 72          | 22.22       | 25          | 3.89        | 21          | 29.44       |
| 71          | 21.67       | 24          | 4.44        | 22          | 30.00       |
| 70          | 21.11       | 23          | 5.00        | 23          | 30.55       |
| 69          | 20.55       | 22          | 5.55        | 24          | 31.11       |
| 68          | 20.00       | 21          | 6.11        | 25          | 31.67       |
| 67          | 19.44       | 20          | 6.67        | 26          | 32.22       |
| 66          | 18.89       | 19          | 7.22        | 27          | 32.78       |
| 65          | 18.33       | 18          | 7.78        | 28          | 33.33       |
| 64          | 17.78       | 17          | 8.33        | 29          | 33.89       |
| 63          | 17.22       | 16          | 8.89        | 30          | 34.44       |
| 62          | 16.67       | 15          | 9.44        | 31          | 35.00       |
| 61          | 16.11       | 14          | 10.00       | 32          | 35.55       |
| 60          | 15.55       | 13          | 10.55       | 33          | 36.11       |
| 59          | 15.00       | 12          | 11.11       | 34          | 36.67       |
| 58          | 14.44       | 11          | 11.67       | 35          | 37.22       |
| 57          | 13.89       | 10          | 12.22       | 36          | 37.78       |
| 56          | 13.33       | 9           | 12.78       | 37          | 38.33       |
| 55          | 12.78       | 8           | 13.33       | 38          | 38.89       |
| 54          | 12.22       | 7           | 13.89       | 39          | 39.44       |
| 53          | 11.67       | + 6         | -14.44      | -40         | -40.00      |
| +52         | +11.11      |             |             |             |             |

## EXPANSIONS AND BOILING-POINTS OF LIQUIDS.

*General Formula,  $V = 1 \pm A t \pm B t^2 \pm C t^3$  in which  $V$  = the Volume at any Temperature  $t$ , the Volume at  $0^\circ$  being unity.*

PIERRE. — Annales de Chimie et de Physique, 3 série, Tomes XV. p. 325, XIX. p. 193, XX. p. 5, XXI. p. 236, XXXI. p. 118, XXXIII. p. 199.

| Name.                  | Formula.          | Boiling Point at 760 mm. | A            | B         | C            | Specific Gravity at $0^\circ$ . | Remarks.                                              |
|------------------------|-------------------|--------------------------|--------------|-----------|--------------|---------------------------------|-------------------------------------------------------|
| Alcohol                | $C_2H_6O_2$       | 78.3                     | + .001048630 | + 0.0000  | 0.00000      | 0.81510                         |                                                       |
| Wood Spirit            | $C_2H_4O_2$       | 66.3                     | .001185569   | 017509900 | + 0.00134518 | 0.82074                         |                                                       |
| Bisulphide of Carbon   | $CS_2$            | 48.0                     | .001139800   | 013706500 | 000911100    | 1.29310                         |                                                       |
| Ether                  | $C_2H_6O$         | 35.7                     | .001513240   | 023590000 | 004005100    | 0.73580                         |                                                       |
| Chloride of Ethyl      | $C_2H_5Cl$        | 11.0                     | .001574578   | 028136000 | 001569870    | 0.92116                         |                                                       |
| Bromide of Ethyl       | $C_2H_5Br$        | 40.8                     | .001337600   | 015013480 | 001690000    | 1.47329                         |                                                       |
| Iodide of Ethyl        | $C_2H_5I$         | 70.3                     | .001142350   | 019638000 | 000620640    | 1.97540                         |                                                       |
| Bromide of Methyl      | $C_2H_5Br$        | 13.0                     | .001415200   | 033152810 | 011380900    | 1.66440                         |                                                       |
| Iodide of Methyl       | $C_2H_5I$         | 44.1                     | .001199590   | 021633180 | 001005000    | 2.19920                         |                                                       |
| Formate of Ethyl       | $C_2H_5O_2$       | 53.2                     | .001325200   | 028624840 | 000661800    | 0.93560                         |                                                       |
| Acetate of Methyl      | $C_2H_5O_4$       | 59.5                     | .001295950   | 029098000 | 000425690    | 0.86680                         |                                                       |
| Fusel Oil              | $C_{10}H_{12}O_2$ | 132.1                    | .000890100   | 006572900 | 001184580    | 0.82705                         | $-15^\circ$ to $+80^\circ$<br>$+80^\circ$ to $+132.1$ |
| Acetate of Ethyl       | $C_2H_5O_4$       | 74.0                     | .001258490   | 006874460 | 001009600    | 0.90691                         |                                                       |
| Butyrate of Methyl     | $C_{10}H_{10}O_4$ | 102.7                    | .001239890   | 006260240 | 001306500    | 1.02928                         |                                                       |
| “ Ethyl                | $C_{12}H_{12}O_4$ | 119.4                    | .001202790   | 000722338 | 002263460    | 0.90190                         | $13^\circ$ to $99^\circ$<br>$99^\circ$ to $119.4$     |
| Chloride of Phosphorus | $PCl_3$           | 78.74                    | .000632742   | 127630000 | 005027800    | 1.61616                         |                                                       |
| Bromide of Phosphorus  | $PBr_3$           | 175.3                    | .001128600   | 008728800 | 1792300000   | 2.92489                         | $0^\circ$ to $100^\circ$<br>$100^\circ$ to $175.3$    |
| Chloride of Arsenic    | $AsCl_3$          | 133.91                   | .000842628   | 009143000 | 000005500    | 2.20495                         |                                                       |
| Bichloride of Tin      | $SnCl_2$          | 115.7                    | .000979072   | 009669000 | 000177700    | 2.26712                         |                                                       |
| “ Titanium             | $TiCl_3$          | 135.9                    | .001132800   | 009117100 | 000757900    | 1.76088                         |                                                       |
|                        |                   |                          | + .000942569 | 013457900 | 000088800    |                                 |                                                       |

|                             |                                               | 59.0   | + .001294100 | + .021840000               | + .004086400             | 1.52370         | Water at 4°<br>= unity.<br>{ melt'g pt. 20°.09<br>20°.09 to 100°.16<br>100°.16 to 132°.8<br>—25°.85 as unity. |
|-----------------------------|-----------------------------------------------|--------|--------------|----------------------------|--------------------------|-----------------|---------------------------------------------------------------------------------------------------------------|
| Chloride of Silicon         | SiCl <sub>2</sub>                             | 59.0   | + .001294100 | + .021840000               | + .004086400             | 1.52370         |                                                                                                               |
| Bromide of Silicon          | SiBr <sub>2</sub>                             | 153.26 | .000952570   | .007567000                 | .000029200               | 2.81280         |                                                                                                               |
| Chloride of Ethylene        | C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub> | 84.92  | .001118900   | .010468600                 | .001034100               | 2.128034        |                                                                                                               |
| Bromide of Ethylene         | C <sub>2</sub> H <sub>4</sub> Br <sub>2</sub> | 132.8  | .0009526908* | .0131650008 <sup>2</sup>   | .0001062688 <sup>3</sup> | 2.16292         |                                                                                                               |
| Bromine                     | Br                                            | 63.04  | .0010167608* | — .0010223008 <sup>2</sup> | .0008788008 <sup>3</sup> | 3.18700         |                                                                                                               |
| Sulphurous Acid             | SO <sub>2</sub>                               | —8.0   | .001033180   | .017113800                 | .000544700               | 3.18700         |                                                                                                               |
| Sulphite of Ethyl           | C <sub>2</sub> H <sub>5</sub> SO <sub>3</sub> | 160.2  | .0014960008  | .2233700008 <sup>2</sup>   | .0495700008 <sup>3</sup> | 1.49110         |                                                                                                               |
| Aldehyde                    | C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>  | 22.1   | .000993479   | .010903880                 | .000153900               | 1.10634         |                                                                                                               |
| Butyric Acid                | C <sub>3</sub> H <sub>6</sub> O <sub>4</sub>  | 163.4  | .001653500   | .085060000                 | .006425800               | 0.80551         |                                                                                                               |
|                             |                                               |        | .001023700   | .008376000                 | .000346900               | 0.98165         | 0° to 100°                                                                                                    |
|                             |                                               |        | .001030400   | .008188900                 | .000333200               | 1.00° to 163°.4 |                                                                                                               |
| Chloride of Chloroethyl     | C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub> | 65.0   | .001290700   | .001183340                 | .002133900               | 1.24074         |                                                                                                               |
| “ Chloroethylene            | C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub> | 114.4  | .001056000   | .002803500                 | .001508800               | 1.42200         | 0° to 75°                                                                                                     |
|                             |                                               |        | .000952700   | .031950000                 | + .000641200             | 75° to 114°.4   |                                                                                                               |
| Chloride of Bichlorethyl    | C <sub>4</sub> H <sub>7</sub> Cl <sub>3</sub> | 75.0   | .001174800   | .035770000                 | — .000536700             | 1.34650         |                                                                                                               |
| Bisulphide of Methyl        | C <sub>2</sub> H <sub>5</sub> S <sub>2</sub>  | 112.7  | .001017000   | .015760000                 | + .000190700             | 1.06358         |                                                                                                               |
| Sulphocyanide of Methyl     | C <sub>2</sub> H <sub>3</sub> NS <sub>2</sub> | 132.96 | .000970070   | .012540000                 | + .001175400             | 1.08794         | 0° to 70°                                                                                                     |
|                             |                                               |        | .000948000   | .025479000                 | — .000246400             | 70° to 132°.96  |                                                                                                               |
| Chloroform                  | C <sub>2</sub> HCl <sub>3</sub>               | 63.0   | .001107000   | .046647000                 | — .001743200             | 1.52520         |                                                                                                               |
| Bichloride of Carbon        | C <sub>2</sub> Cl <sub>4</sub>                | 78.6   | .001183800   | .008988000                 | + .001351300             | 1.62983         |                                                                                                               |
| Sulphide of Ethyl           | C <sub>2</sub> H <sub>5</sub> S <sub>2</sub>  | 91.0   | .001196400   | .018065000                 | .000788200               | 0.83672         |                                                                                                               |
| Chloride of Amyl            | C <sub>10</sub> H <sub>17</sub> Cl            | 102.0  | .001171500   | .005007700                 | .001353684               | 0.89584         |                                                                                                               |
| Bromide of Amyl             | C <sub>10</sub> H <sub>17</sub> Br            | 118.6  | .001023000   | .019008600                 | .000197500               | 1.16576         | 0° to 80°                                                                                                     |
|                             |                                               |        | .001070900   | .008544500                 | + .000764000             | 80° to 118°.6   |                                                                                                               |
| Chloride of Bichlorethylene | C <sub>4</sub> H <sub>2</sub> Cl <sub>4</sub> | 138.5  | .000835619   | .065877000                 | — .005414000             | 1.61158         | 0° to 60°                                                                                                     |
| “ Trichlorethylene          | C <sub>2</sub> HCl <sub>3</sub>               | 153.7  | .009771680   | .007347800                 | + .000401000             | 60° to 138°.5   |                                                                                                               |
|                             |                                               |        | .000899000   | .024577700                 | + .001286400             | 0° to 75°       |                                                                                                               |
|                             |                                               |        | .000973390   | .000257700                 | — .000636400             | 75° to 153°.7   |                                                                                                               |
| Protochloride of Carbon     | C <sub>4</sub> Cl <sub>4</sub>                | 123.9  | .001002600   | .003279800                 | + .001593390             | 1.64900         | 0° to 75°                                                                                                     |
|                             |                                               |        | .000920800   | .034007450                 | — .001007500             | 75° to 123°.9   |                                                                                                               |
|                             |                                               |        | .000896550   | .020366800                 | .000748360               | 0.87179         | 0° to 80°                                                                                                     |
| Terebene                    | C <sub>20</sub> H <sub>10</sub>               | 161.6  | + .000879250 | + .018095000               | — .000172600             | 80° to 161°.6   |                                                                                                               |

\* δ = t — t' t' = the melting point or point taken as unity.

## EXPANSIONS AND BOILING-POINTS OF LIQUIDS.

*General Formula for the Expansion of Liquids,  $V = 1 \pm A t \pm B t^2 \pm C t^3$ .*

KOPP. — Annalen der Physik u. Chemie, LXXII. 1–223. Annalen der Chem. und Phar. XCIV. 257, XCV. 307, XCVIII. 367.

| Name.                 | Formula.          | Boiling Point<br>at 760 mm.<br>°C | A                    | B                   | C          | Specific<br>Gravity<br>at 0°. | Remarks.        |
|-----------------------|-------------------|-----------------------------------|----------------------|---------------------|------------|-------------------------------|-----------------|
| Wood Spirit           | $C_2H_5O_2$       | 65.8                              | + .00113420          | + 13635000          | 0.000000   | 0.81420                       |                 |
| Fusel Oil             | $C_{10}H_{12}O_2$ | 132.2                             | .00097240            | — 08565100          | + 02021800 | 0.82480                       |                 |
| Valeraldehyde         | $C_{10}H_{10}O_2$ | 93.6                              | .00119360            | + 29750000          | — 00418070 | 0.82240                       |                 |
| Anhydrous Acetic Acid | $C_6H_6O_6$       | 137.9                             | .00105307            | + 18389000          | + 00079165 | 1.09690                       |                 |
| Acetate of Amyl       | $C_{14}H_{14}O_4$ | 137.9                             | .00115010            | — 00904600          | 01301500   | 0.88370                       |                 |
| Valerate of Amyl      | $C_{20}H_{20}O_4$ | 188.9                             | .00103170            | + 00832540          | 00768980   | 0.87930                       |                 |
| Oxalate of Ethyl      | $C_{12}H_{10}O_8$ | 186.1                             | .00106880            | 08417000            | 00472550   | 1.10160                       |                 |
| Salicylate of Methyl  | $C_{16}H_{16}O_6$ | 232.7                             | .00084360            | 04008200            | 00255050   | 1.19690                       |                 |
| Benzoic Acid          | $C_{14}H_{10}O_4$ | 249.9                             | .00080370 $\delta^*$ | 12459000 $\delta^2$ |            | 1.08380                       | melts at 121°4. |
| Benzoate of Methyl    | $C_{16}H_{14}O_4$ | 199.7                             | .00089390            | + 08529000          | 00259360   | 1.10260                       |                 |
| “ Ethyl               | $C_{18}H_{18}O_4$ | 213.4                             | .00093094            | — 00634290          | 00499280   | 1.06570                       |                 |
| “ Amyl                | $C_{24}H_{24}O_4$ | 261.2                             | .00082495            | + 07303500          | 00128330   | 1.00390                       |                 |
| Benzoic Alcohol       | $C_{14}H_{12}O_2$ | 206.8                             | .00078730            | + 05129900          | 00272500   | 1.06280                       |                 |
| Oil of Bitter Almonds | $C_{14}H_{10}O_2$ | 179.4                             | .00094020            | — 08204500          | 00806000   | 1.06360                       |                 |
| Cuminol               | $C_{20}H_{18}O_2$ | 237.0                             | .00084150            | + 02222000          | 00348430   | 0.98320                       |                 |
| Cymol                 | $C_{10}H_{14}$    | 178.1                             | .00094060            | 03808500            | 00486670   | 0.87780                       |                 |
| Propionic Acid        | $C_6H_6O_4$       | 141.8                             | .00110030            | + 02181600          | 00697960   | 1.01610                       |                 |
| Valeric “             | $C_{10}H_{10}O_4$ | 176.3                             | .00104760            | — 02400100          | + 00824660 | 0.95550                       |                 |
| Phenol                | $C_{12}H_{10}O_2$ | 188.6                             | .00067440            | + 17210000          | — 00050408 | 1.08080                       |                 |
| Propionate of Ethyl   | $C_{10}H_{10}O_4$ | 97.7                              | .00128600            | 05138600            | + 01730500 | 0.92310                       |                 |
| Cinnamate “           | $C_{22}H_{12}O_4$ | 266.6                             | .00081090            | 06401600            | 00143760   | 1.06560                       |                 |
| Oxalate of Methyl     | $C_8H_6O_8$       | 161.1                             | .00107900 $\delta$   | 15554000 $\delta^2$ |            | 1.15660                       | melts at 50°.   |
| Carbonate of Ethyl    | $C_{10}H_{10}O_6$ | 126.4                             | .00117110            | 03259600            | 00985210   | 0.99980                       |                 |
| Succinate “           | $C_{16}H_{14}O_8$ | 217.7                             | .00100880            | 03328200            | 00517010   | 1.07180                       |                 |

\*  $\delta$  = Number of degrees above melting point.



|                      |                                                              | + .00074700δ | + 18095000δ <sup>2</sup> |            |         |
|----------------------|--------------------------------------------------------------|--------------|--------------------------|------------|---------|
| Naphthalin           | C <sub>10</sub> H <sub>8</sub>                               | 216.8        |                          |            | 0.97740 |
| Butyl                | C <sub>10</sub> H <sub>18</sub>                              | 109.0        | + .00121250              | + 02793000 | 0.71350 |
| Chloride of Amyl     | C <sub>10</sub> H <sub>17</sub> Cl                           | 101.4        | .00092940                |            | 0.88590 |
| " Butyl              | C <sub>8</sub> H <sub>7</sub> Cl <sub>2</sub>                | 122.8        | .00131540                |            | 1.09530 |
| " Acetyl             | C <sub>4</sub> H <sub>9</sub> O <sub>2</sub> Cl <sub>2</sub> | 56.0         | .00083393                |            | 1.13050 |
| " Benzoyl            | C <sub>14</sub> H <sub>5</sub> O <sub>2</sub> Cl             | 198.4        | .00095450                | + 00271390 | 1.23240 |
| Chloral              | C <sub>4</sub> HClO <sub>2</sub> O <sub>2</sub>              | 99.6         | .00096500 *              | 05639200   | 1.51830 |
| Iodide of Amyl       | C <sub>10</sub> H <sub>17</sub> I                            | 148.4        | .00103250                | 00241110   | 1.46760 |
| Amyl Mercaptan       | C <sub>10</sub> H <sub>17</sub> S <sub>2</sub>               | 120.1        | .00080540δ               | + 00153180 | 0.85480 |
| Chloride of Antimony | SbCl <sub>3</sub>                                            | 223.5        | .00057600δ               |            | 2.67500 |
| Bromide              | SbBr <sub>3</sub>                                            | 275.4        | .00095910                |            | 3.64100 |
| Chloride of Sulphur  | S <sub>2</sub> Cl                                            | 144.0        | .00112900                | + 00731860 | 1.70550 |
| Nitrate of Ethyl     | C <sub>4</sub> H <sub>5</sub> NO <sub>6</sub>                | 87.4         | .00082630                | - 01841300 | 1.13220 |
| Nitrobenzol          | C <sub>12</sub> H <sub>5</sub> NO <sub>4</sub>               | 220.2-221.1  | .00081730                | + 00137790 | 1.20020 |
| Aniline              | C <sub>10</sub> H <sub>7</sub> N                             | 185.6        | .00121180                | 00062784   | 1.03610 |
| Cyanide of Methyl    | C <sub>4</sub> H <sub>3</sub> N                              | 71.4-72.6    | .00093380                | 01532200   | 0.83470 |
| " Phenyl             | C <sub>14</sub> H <sub>5</sub> N                             | 191.5        | .00107130                | 00579600   | 1.02300 |
| Mustard Oil          | C <sub>8</sub> H <sub>9</sub> NS <sub>2</sub>                | 151.8        | .00104139                | 00735690   | 1.02820 |
| Alcohol              | C <sub>4</sub> H <sub>9</sub> O <sub>2</sub>                 | 78.4         | .00148026                | 01761800   | 0.80950 |
| Ether                | C <sub>8</sub> H <sub>10</sub> O <sub>2</sub>                | 34.9         | .00154640                | 02700700   | 0.73660 |
| Aldehyde             | C <sub>4</sub> H <sub>4</sub> O <sub>2</sub>                 | 20.8         | .00134810                |            | 0.80092 |
| Acetone              | C <sub>3</sub> H <sub>3</sub> O                              | 56.3         | .00117626                | 01056830   | 0.81440 |
| Benzol               | C <sub>12</sub> H <sub>6</sub> O <sub>4</sub>                | 80.8         | .00099269                | 00806480   | 0.89911 |
| Formic Acid          | C <sub>2</sub> H <sub>2</sub> O <sub>4</sub>                 | 105.3        | .00105703                | 00596500   | 1.22270 |
| Acetic "             | C <sub>4</sub> H <sub>4</sub> O <sub>4</sub>                 | 117.3        | .00104610                | 00964350   | 1.08005 |
| Butyric "            | C <sub>8</sub> H <sub>8</sub> O <sub>4</sub>                 | 157.0        | .00140550                | 00542010   | 0.98860 |
| Formate of Methyl    | C <sub>4</sub> H <sub>4</sub> O <sub>4</sub>                 | 33.4         | .00136446                | 04594700   | 0.99840 |
| " Ethyl              | C <sub>6</sub> H <sub>6</sub> O <sub>4</sub>                 | 54.9         | .00127790                | 03924800   | 0.94474 |
| Acetate of Methyl    | C <sub>6</sub> H <sub>6</sub> O <sub>4</sub>                 | 56.3         | .00127380                | 00363900   | 0.95620 |
| " Ethyl              | C <sub>8</sub> H <sub>8</sub> O <sub>4</sub>                 | 74.3         | .00119565                | 01179700   | 0.91046 |
| Butyrate of Methyl   | C <sub>10</sub> H <sub>10</sub> O <sub>4</sub>               | 98.6         | .00117817                | 00982920   | 0.92098 |
| " Ethyl              | C <sub>12</sub> H <sub>12</sub> O <sub>4</sub>               | 114.8        | .00112115                | 00956000   | 0.90412 |
| Valerate of Methyl   | C <sub>12</sub> H <sub>12</sub> O <sub>4</sub>               | 116.2        |                          | + 00586270 | 0.90150 |

## TABLE

OF THE ELEVATION OF THE BOILING POINT BY DISSOLVING SALTS  
IN WATER.

LEGRAND. — Annales de Chemie et de Physique.

*The salts are nearly all anhydrous.*

| Name of Salt.          | Boiling Point C°. | Proportion of salt<br>to 100 of Water. |
|------------------------|-------------------|----------------------------------------|
| Chloride of Barium     | 104.40            | 60.1                                   |
| Chlorate of Potassium  | 104.20            | 61.5                                   |
| Carbonate of Sodium    | 104.63            | 48.5                                   |
| Phosphate of Sodium    | 106.60            | 112.6                                  |
| Chloride of Potassium  | 108.30            | 59.4                                   |
| Chloride of Sodium     | 108.40            | 41.2                                   |
| Chloride of Ammonium   | 114.20            | 88.9                                   |
| Tartrate of Potassium  | 114.67            | 296.2                                  |
| Nitrate of Potassium   | 115.90            | 335.1                                  |
| Chloride of Strontium  | 117.85            | 117.5                                  |
| Nitrate of Sodium      | 121.00            | 224.0                                  |
| Acetate of Sodium      | 124.37            | 209.0                                  |
| Carbonate of Potassium | 135.00            | 205.0                                  |
| Nitrate of Calcium     | 151.00            | 362.2                                  |
| Acetate of Potassium   | 169.00            | 798.2                                  |
| Chloride of Lime       | 179.50            | 325.0                                  |
| Nitrate of Ammonia     | 180.00            | Any Amount.                            |

## TABLE

OF THE VOLUME OF WATER AT DIFFERENT TEMPERATURES.

| Temperature.     | Kopp. | Calculated by Frank-<br>enheim from Pierre's<br>formulas. | Depretz. Water<br>at 4° C = 1. |
|------------------|-------|-----------------------------------------------------------|--------------------------------|
| —15 <sup>o</sup> |       | 1.0037584                                                 |                                |
| 10               |       | 1.0016851                                                 |                                |
| 9                |       | 1.0014013                                                 | 1.0016311                      |
| 8                |       | 1.0011526                                                 | 1.0013734                      |
| 7                |       | 1.0009355                                                 | 1.0011354                      |
| 6                |       | 1.0007465                                                 | 1.0009184                      |
| 5                |       | 1.0005819                                                 | 1.0006987                      |
| 4                |       | 1.0004382                                                 | 1.0005619                      |
| 3                |       | 1.0003117                                                 | 1.0004222                      |
| 2                |       | 1.0001989                                                 | 1.0003077                      |
| — 1              |       | 1.0000962                                                 | 1.0002138                      |



| Temperature. | Kopp.    | Calculated by Frank-<br>enheim from Pierre's<br>formulas. | Depretz. Water<br>at 4° C = 1. |
|--------------|----------|-----------------------------------------------------------|--------------------------------|
| 0            | 1.000000 | 1.0000000                                                 | 1.0001269                      |
| + 1          | 0.999947 | 0.9999458                                                 | 1.0000730                      |
| 2            | 0.999908 | 0.9999094                                                 | 1.0000331                      |
| 3            | 0.999885 | 0.9998878                                                 | 1.0000083                      |
| 4            | 0.999877 | 0.9998820                                                 | 1.0000000                      |
| 5            | 0.999883 | 0.9998903                                                 | 1.0000082                      |
| 6            | 0.999903 | 0.9999148                                                 | 1.0000309                      |
| 7            | 0.999938 | 0.9999524                                                 | 1.0000708                      |
| 8            | 0.999986 | 1.0000044                                                 | 1.0001216                      |
| 9            | 1.000048 | 1.0000694                                                 | 1.0001879                      |
| 10           | 1.000124 | 1.0001482                                                 | 1.0002684                      |
| 11           | 1.000213 | 1.0002392                                                 | 1.0003598                      |
| 12           | 1.000314 | 1.0003420                                                 | 1.0004724                      |
| 13           | 1.000429 | 1.0004557                                                 | 1.0005862                      |
| 14           | 1.000556 | 1.0005877                                                 | 1.0007146                      |
| 15           | 1.000695 | 1.0007275                                                 | 1.0008751                      |
| 16           | 1.000846 | 1.0008784                                                 | 1.0010215                      |
| 17           | 1.001010 | 1.0010404                                                 | 1.0012067                      |
| 18           | 1.001184 | 1.0012132                                                 | 1.0013900                      |
| 19           | 1.001370 | 1.0013965                                                 | 1.0015800                      |
| 20           | 1.001567 | 1.0015940                                                 | 1.0017900                      |
| 21           | 1.001776 | 1.0017997                                                 | 1.0020000                      |
| 22           | 1.001995 | 1.0020108                                                 | 1.0022200                      |
| 23           | 1.002225 | 1.0022310                                                 | 1.0024400                      |
| 24           | 1.002465 | 1.0024648                                                 | 1.0027100                      |
| 25           | 1.002715 | 1.0027075                                                 | 1.0029300                      |
| 26           |          | 1.0029588                                                 | 1.0032100                      |
| 27           |          | 1.0032211                                                 | 1.0034500                      |
| 28           |          | 1.0034944                                                 | 1.0037400                      |
| 29           |          | 1.0037758                                                 | 1.0040300                      |
| 30           | 1.004064 | 1.0040710                                                 | 1.0043300                      |
| 35           | 1.005697 | 1.0056770                                                 | 1.0059300                      |
| 40           | 1.007531 | 1.0075120                                                 | 1.0077300                      |
| 45           | 1.009541 | 1.0095625                                                 | 1.0098500                      |
| 50           | 1.011766 | 1.0118150                                                 | 1.0120500                      |
| 55           | 1.014100 | 1.0143596                                                 | 1.0144500                      |
| 60           | 1.016590 | 1.0171180                                                 | 1.0169800                      |
| 65           | 1.019302 | 1.0199465                                                 | 1.0196700                      |
| 70           | 1.022246 | 1.0229376                                                 | 1.0225500                      |
| 75           | 1.025440 | 1.0260782                                                 | 1.0256200                      |
| 80           | 1.028581 | 1.0293600                                                 | 1.0288500                      |
| 85           | 1.031894 | 1.0327692                                                 | 1.0322500                      |
| 90           | 1.035397 | 1.0362943                                                 | 1.0356600                      |
| 95           | 1.039094 | 1.0399247                                                 | 1.0392500                      |
| +100         | 1.042986 | 1.0436490                                                 | 1.0431500                      |



## TENSION OF THE VAPOR OF ALCOHOL.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 374.

*In this and the following Tables of Tensions of Vapor the Temperature is in degrees of the Air Thermometer.*

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |
| —20                    | 3.34     | 20                     | 44.46    | 60                     | 350.21   | 95                     | 1425.13  | 135                    | 4964.22  |
| —15                    | 5.10     | 25                     | 59.37    | 65                     | 436.90   | 100                    | 1697.55  | 140                    | 5674.59  |
| —10                    | 6.47     | 30                     | 78.52    | 70                     | 541.15   | 105                    | 2010.38  | 145                    | 6458.10  |
| — 5                    | 9.09     | 35                     | 102.91   | 75                     | 665.54   | 110                    | 2367.64  | 150                    | 7318.40  |
| 0                      | 12.70    | 40                     | 133.69   | 78.26                  | 760.00   | 115                    | 2773.40  | 155                    | 8259.19  |
| + 5                    | 17.62    | 45                     | 172.18   | 80                     | 812.91   | 120                    | 3231.73  |                        |          |
| 10                     | 24.23    | 50                     | 219.90   | 85                     | 986.40   | 125                    | 3746.88  |                        |          |
| 15                     | 32.98    | 55                     | 278.59   | 90                     | 1189.30  | 130                    | 4323.00  |                        |          |

## TENSION OF THE VAPOR OF ETHER.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 392.

| Tem-<br>pera-<br>ture | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|-----------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                       | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |
| —20                   | 68.90    | 10                     | 286.83   | 35                     | 761.20   | 65                     | 1998.87  | 95                     | 4401.81  |
| —15                   | 89.31    | 15                     | 353.62   | 40                     | 907.04   | 70                     | 2304.90  | 100                    | 4953.30  |
| —10                   | 114.72   | 20                     | 432.78   | 45                     | 1074.15  | 75                     | 2645.41  | 105                    | 5556.23  |
| — 5                   | 146.06   | 25                     | 525.93   | 50                     | 1264.83  | 80                     | 3022.79  | 110                    | 6214.63  |
| 0                     | 184.39   | 30                     | 634.80   | 55                     | 1481.06  | 85                     | 3439.53  | 115                    | 6933.26  |
| + 5                   | 230.89   | 34.97                  | 760.00   | 60                     | 1725.01  | 90                     | 3898.26  | 120                    | 7719.20  |

## TENSION OF THE VAPOR OF BISULPHIDE OF CARBON.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 402.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |
| —20                    | 47.30    | 20                     | 298.03   | 55                     | 1001.57  | 95                     | 2966.34  | 135                    | 6925.90  |
| —15                    | 61.64    | 25                     | 361.13   | 60                     | 1164.51  | 100                    | 3325.15  | 140                    | 7603.96  |
| —10                    | 79.44    | 30                     | 434.62   | 65                     | 1347.52  | 105                    | 3727.19  | 145                    | 8326.92  |
| — 5                    | 101.29   | 35                     | 519.66   | 70                     | 1552.09  | 110                    | 4164.06  | 150                    | 9095.94  |
| 0                      | 127.91   | 40                     | 617.53   | 75                     | 1779.88  | 115                    | 4637.41  |                        |          |
| + 5                    | 160.01   | 45                     | 729.53   | 80                     | 2032.53  | 120                    | 5148.79  |                        |          |
| 10                     | 198.46   | 46.20                  | 760.00   | 85                     | 2311.70  | 125                    | 5699.69  |                        |          |
| 15                     | 244.13   | 50                     | 857.07   | 90                     | 2619.08  | 130                    | 6291.60  |                        |          |

## TENSION OF THE VAPOR OF CHLOROFORM.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 415.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |
| +20                    | 160.47   | 55                     | 637.71   | 85                     | 1624.10  | 120                    | 3925.74  | 155                    | 7985.35  |
| 25                     | 200.18   | 60                     | 755.44   | 90                     | 1865.22  | 125                    | 4386.60  | 160                    | 8734.20  |
| 30                     | 247.51   | 60.16                  | 760.00   | 95                     | 2132.85  | 130                    | 4885.10  | 165                    | 9527.82  |
| 35                     | 303.49   | 65                     | 889.72   | 100                    | 2428.54  | 135                    | 5422.53  |                        |          |
| 40                     | 369.26   | 70                     | 1042.11  | 105                    | 2754.03  | 140                    | 6000.16  |                        |          |
| 45                     | 446.01   | 75                     | 1214.20  | 110                    | 3110.99  | 145                    | 6619.20  |                        |          |
| 50                     | 535.05   | 80                     | 1407.64  | 115                    | 3501.03  | 150                    | 7280.62  |                        |          |

## TENSION OF THE VAPOR OF BENZINE.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 428.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |
| —20                    | 5.79     | 20                     | 75.65    | 60                     | 390.10   | 95                     | 1167.46  | 135                    | 3158.51  |
| —15                    | 8.82     | 25                     | 95.91    | 65                     | 463.43   | 100                    | 1340.05  | 140                    | 3520.73  |
| —10                    | 12.92    | 30                     | 120.24   | 70                     | 547.42   | 105                    | 1531.83  | 145                    | 3912.11  |
| — 5                    | 18.33    | 35                     | 149.26   | 75                     | 643.18   | 110                    | 1744.12  | 150                    | 4333.71  |
| 0                      | 25.31    | 40                     | 183.62   | 80                     | 751.86   | 115                    | 1978.22  |                        |          |
| + 5                    | 34.17    | 45                     | 224.06   | 80.36                  | 760.00   | 120                    | 2235.44  |                        |          |
| 10                     | 45.25    | 50                     | 271.37   | 85                     | 874.63   | 125                    | 2517.06  |                        |          |
| 15                     | 58.93    | 55                     | 326.41   | 90                     | 1012.75  | 130                    | 2824.35  |                        |          |

TENSION OF THE VAPOR OF CHLORIDE OF CARBON, (C<sub>2</sub>Cl<sub>6</sub>).

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 439.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        |          |                        | mm.      |                        | mm.      |                        | mm.      |                        | mm.      |
| —20                    | 9.80     | 25                     | 114.30   | 70                     | 621.15   | 110                    | 1887.44  | 155                    | 5010.21  |
| —15                    | 13.55    | 30                     | 142.27   | 75                     | 725.66   | 115                    | 2129.15  | 160                    | 5513.14  |
| —10                    | 18.47    | 35                     | 175.55   | 76.5                   | 760.00   | 120                    | 2393.67  | 165                    | 6053.83  |
| — 5                    | 24.83    | 40                     | 214.81   | 80                     | 843.29   | 125                    | 2682.41  | 170                    | 6634.37  |
| 0                      | 32.95    | 45                     | 260.82   | 85                     | 975.12   | 130                    | 2996.88  | 175                    | 7256.87  |
| + 5                    | 43.19    | 50                     | 314.38   | 90                     | 1122.26  | 135                    | 3338.56  | 180                    | 7923.55  |
| 10                     | 55.97    | 55                     | 376.29   | 95                     | 1286.86  | 140                    | 3709.04  | 185                    | 8636.78  |
| 15                     | 71.73    | 60                     | 447.43   | 100                    | 1467.09  | 145                    | 4109.99  | 190                    | 9399.02  |
| 20                     | 90.99    | 65                     | 528.74   | 105                    | 1667.19  | 150                    | 4543.13  |                        |          |



## TENSION OF THE VAPOR OF CHLORIDE OF ETHYL.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 446.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 110.24   | 0                      | 465.18   | 25                     | 1184.17  | 55                     | 2668.43  | 85                     | 6301.61  |
| —25                    | 145.01   | + 5                    | 569.32   | 30                     | 1398.99  | 60                     | 3400.54  | 90                     | 7047.51  |
| —20                    | 187.85   | 10                     | 691.11   | 35                     | 1643.24  | 65                     | 3878.52  | 95                     | 7853.92  |
| —15                    | 239.60   | 12.5                   | 760.00   | 40                     | 1619.58  | 70                     | 4405.03  | 100                    | 8722.76  |
| —10                    | 302.09   | 15                     | 832.56   | 45                     | 2230.71  | 75                     | 4982.72  |                        |          |
| — 5                    | 376.72   | 20                     | 996.23   | 50                     | 2579.40  | 80                     | 5614.11  |                        |          |

## TENSION OF THE VAPOR OF BROMIDE OF ETHYL.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 453.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 32.18    | 0                      | 257.40   | 45                     | 947.28   | 85                     | 3000.63  | 125                    | 7362.25  |
| —25                    | 44.06    | 15                     | 316.92   | 50                     | 1112.79  | 90                     | 3398.95  | 130                    | 8116.49  |
| —20                    | 59.16    | 20                     | 387.03   | 55                     | 1300.35  | 95                     | 3835.53  | 135                    | 8921.92  |
| —15                    | 78.09    | 25                     | 469.07   | 60                     | 1511.92  | 100                    | 4312.32  | 140                    | 9779.56  |
| —10                    | 101.54   | 30                     | 564.51   | 65                     | 1749.47  | 105                    | 4831.22  |                        |          |
| — 5                    | 130.58   | 35                     | 674.92   | 70                     | 2015.06  | 110                    | 5394.01  |                        |          |
| 0                      | 665.57   | 38.37                  | 760.00   | 75                     | 2310.73  | 115                    | 6002.41  |                        |          |
| + 5                    | 207.21   | 40                     | 801.92   | 80                     | 2638.57  | 120                    | 6658.00  |                        |          |

## TENSION OF THE VAPOR OF IODIDE OF ETHYL.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 456.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| 0                      | 41.95    | 15                     | 87.64    | 30                     | 169.07   | 45                     | 303.77   | 60                     | 512.25   |
| 15                     | 54.14    | 20                     | 110.02   | 35                     | 207.09   | 50                     | 364.00   |                        |          |
| 10                     | 69.20    | 25                     | 136.95   | 40                     | 251.73   | 55                     | 433.21   |                        |          |

## TENSION OF THE VAPOR OF WOOD SPIRIT.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 460.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 2.67     | 10                     | 50.13    | 50                     | 381.68   | 85                     | 1470.92  | 125                    | 4980.55  |
| —25                    | 4.14     | 15                     | 67.11    | 55                     | 472.20   | 90                     | 1741.67  | 130                    | 5691.30  |
| —20                    | 6.27     | 20                     | 88.67    | 60                     | 579.93   | 95                     | 2051.71  | 135                    | 6479.32  |
| —15                    | 9.29     | 25                     | 115.99   | 65                     | 707.33   | 100                    | 2405.15  | 140                    | 7337.10  |
| —10                    | 13.47    | 30                     | 149.99   | 66.78                  | 760.00   | 105                    | 2806.27  | 145                    | 8308.87  |
| — 5                    | 19.17    | 35                     | 192.01   | 70                     | 857.10   | 110                    | 3259.60  | 150                    | 9361.35  |
| 0                      | 26.82    | 40                     | 243.51   | 75                     | 1032.14  | 115                    | 3769.80  |                        |          |
| + 5                    | 36.89    | 45                     | 306.13   | 80                     | 1238.47  | 120                    | 4341.77  |                        |          |

## TENSION OF THE VAPOR OF ACETONE.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 472.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| +20                    | 179.63   | 50                     | 602.86   | 70                     | 1189.38  | 95                     | 2452.81  | 120                    | 4546.86  |
| 25                     | 226.27   | 55                     | 725.95   | 75                     | 1387.62  | 100                    | 2797.27  | 125                    | 5086.25  |
| 30                     | 281.00   | 56.3                   | 760.00   | 80                     | 1611.05  | 105                    | 3177.00  | 130                    | 5669.72  |
| 35                     | 345.15   | 60                     | 860.48   | 85                     | 1861.81  | 110                    | 3593.96  | 135                    | 6298.68  |
| 40                     | 420.15   | 65                     | 1014.32  | 90                     | 2141.66  | 115                    | 4050.02  | 140                    | 6974.43  |
| 45                     | 507.52   |                        |          |                        |          |                        |          |                        |          |

## TENSION OF THE VAPOR OF BROMIDE OF ETHYLENE.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 468.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
|                        | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —25                    | 1.55     | 30                     | 17.20    | 85                     | 172.92   | 135                    | 833.26   | 190                    | 3020.83  |
| —20                    | 1.73     | 35                     | 21.80    | 90                     | 206.58   | 140                    | 953.00   | 195                    | 3833.45  |
| —15                    | 2.03     | 40                     | 27.49    | 95                     | 245.51   | 145                    | 1085.89  | 200                    | 3668.36  |
| —10                    | 2.48     | 45                     | 34.47    | 100                    | 290.43   | 150                    | 1232.83  | 205                    | 4026.25  |
| — 5                    | 3.09     | 50                     | 42.99    | 105                    | 342.11   | 155                    | 1394.73  | 210                    | 4407.52  |
| 0                      | 3.92     | 55                     | 53.31    | 110                    | 401.08   | 160                    | 1572.49  | 215                    | 4812.84  |
| + 5                    | 5.01     | 60                     | 65.75    | 115                    | 468.13   | 165                    | 1766.99  | 220                    | 5242.61  |
| 10                     | 6.42     | 65                     | 80.64    | 120                    | 544.06   | 170                    | 1979.14  | 225                    | 5597.17  |
| 15                     | 8.25     | 70                     | 98.36    | 125                    | 629.66   | 175                    | 2209.77  | 230                    | 6176.87  |
| 20                     | 10.57    | 75                     | 119.34   | 130                    | 725.77   | 180                    | 2459.73  | 235                    | 6681.92  |
| 25                     | 13.51    | 80                     | 144.02   | 131.6                  | 760.00   | 185                    | 2729.84  | 240                    | 7212.51  |



TENSION OF THE VAPOR OF CHLORIDE OF SILICON ( $\text{SiCl}_2$ ).

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 476.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —25                    | 19.66    | —5                     | 60.52    | 15                     | 157.74   | 35                     | 356.83   | 55                     | 715.44   |
| —20                    | 26.49    | 0                      | 78.62    | 20                     | 195.86   | 40                     | 429.08   | 56.81                  | 760.00   |
| —15                    | 35.28    | +5                     | 99.59    | 25                     | 241.15   | 45                     | 512.32   | 60                     | 837.23   |
| —10                    | 46.46    | 10                     | 125.90   | 30                     | 294.49   | 50                     | 607.46   | 65                     | 973.74   |

## TENSION OF THE VAPOR OF TERCHLORIDE OF PHOSPHORUS.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 478.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| 0                      | 37.98    | 20                     | 100.55   | 40                     | 233.78   | 55                     | 408.46   | 70                     | 674.23   |
| +5                     | 49.09    | 25                     | 125.59   | 45                     | 283.46   | 60                     | 485.63   | 73.80                  | 760.00   |
| 10                     | 62.88    | 30                     | 155.65   | 50                     | 341.39   | 65                     | 573.86   | 75                     | 787.61   |
| 15                     | 79.85    | 35                     | 191.45   |                        |          |                        |          |                        |          |

## TENSION OF THE VAPOR OF TERCHLORIDE OF BORON.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 480.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 98.25    | —5                     | 310.30   | 18.23                  | 760.00   | 40                     | 1535.25  | 65                     | 3010.24  |
| —25                    | 125.68   | 0                      | 381.32   | 20                     | 807.50   | 45                     | 1775.69  | 70                     | 3392.12  |
| —20                    | 159.46   | +5                     | 465.03   | 25                     | 957.29   | 50                     | 2042.25  | 75                     | 3804.79  |
| —15                    | 200.69   | 10                     | 562.94   | 30                     | 1127.50  | 55                     | 2336.17  | 80                     | 4248.28  |
| —10                    | 250.54   | 15                     | 676.57   | 35                     | 1319.66  | 60                     | 2658.52  | 85                     | 4720.11  |

## TENSION OF THE VAPOR OF CHLORIDE OF CYANOGEN.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 484.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 68.30    | —5                     | 350.20   | 15                     | 830.30   | 40                     | 1987.96  | 65                     | 4232.24  |
| —25                    | 103.38   | 0                      | 444.11   | 20                     | 1001.87  | 45                     | 2329.77  | 70                     | 4873.19  |
| —20                    | 148.21   | +5                     | 553.99   | 25                     | 1199.76  | 50                     | 2719.29  | 75                     | 5594.58  |
| —15                    | 203.58   | 10                     | 681.92   | 30                     | 1427.43  | 55                     | 3162.11  |                        |          |
| —10                    | 270.51   | 12.66                  | 760.00   | 35                     | 1688.74  | 60                     | 3664.24  |                        |          |

## TENSION OF THE VAPOR OF OIL OF TURPENTINE.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 501.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| 0                      | 2.07     | 60                     | 26.46    | 120                    | 257.21   | 160                    | 775.09   | 190                    | 1473.24  |
| 10                     | 2.94     | 70                     | 40.64    | 130                    | 348.98   | 165                    | 871.27   | 195                    | 1618.26  |
| 20                     | 4.45     | 80                     | 61.30    | 140                    | 464.02   | 170                    | 975.42   | 200                    | 1771.47  |
| 30                     | 6.87     | 90                     | 90.61    | 150                    | 605.20   | 175                    | 1090.11  |                        |          |
| 40                     | 10.80    | 100                    | 131.11   | 155                    | 686.37   | 180                    | 1207.92  |                        |          |
| 50                     | 16.98    | 110                    | 185.62   | 159.2                  | 760.00   | 185                    | 1336.45  |                        |          |

## TENSION OF THE VAPOR OF SULPHUR.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 530.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| 390                    | 272.31   | 430                    | 560.98   | 470                    | 1063.17  | 510                    | 1871.57  | 550                    | 3086.51  |
| 400                    | 328.98   | 440                    | 663.11   | 480                    | 1232.70  | 520                    | 2133.30  | 560                    | 3465.33  |
| 410                    | 395.20   | 450                    | 779.89   | 490                    | 1422.88  | 530                    | 2421.97  | 570                    | 3877.08  |
| 420                    | 472.11   | 460                    | 912.74   | 500                    | 1635.32  | 540                    | 2739.21  |                        |          |

## TENSION OF THE VAPOR OF SULPHUROUS ACID.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 590.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 287.47   | —10                    | 762.49   | 10                     | 1799.55  | 30                     | 3431.80  | 50                     | 6220.01  |
| —25                    | 373.79   | —5                     | 946.90   | 15                     | 2064.90  | 35                     | 4014.78  | 55                     | 7125.02  |
| —20                    | 479.46   | 0                      | 1165.06  | 20                     | 2462.05  | 40                     | 4670.23  | 60                     | 8123.80  |
| —15                    | 607.90   | +5                     | 1421.14  | 25                     | 2915.97  | 45                     | 5403.52  | 65                     | 9221.40  |
| 10.08                  | 760.00   |                        |          |                        |          |                        |          |                        |          |

## TENSION OF THE VAPOR OF OXIDE OF METHYL.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 593.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 576.54   | —20                    | 882.00   | —5                     | 1572.51  | 10                     | 2628.97  | 25                     | 4151.00  |
| —25                    | 716.08   | —15                    | 1077.67  | 0                      | 1879.02  | 15                     | 3079.80  | 30                     | 4777.99  |
| 23.65                  | 760.00   | —10                    | 1306.63  | +5                     | 2229.93  | 20                     | 3586.01  |                        |          |

## TENSION OF THE VAPOR OF CHLORIDE OF METHYL.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 595.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —30                    | 578.99   | —20                    | 883.25   | —5                     | 1578.70  | 10                     | 2663.81  | 25                     | 4267.40  |
| —25                    | 717.76   | —15                    | 1079.20  | 0                      | 1891.00  | 15                     | 3134.10  | 30                     | 4940.46  |
| 23.73                  | 760.00   | —10                    | 1309.61  | +5                     | 2251.08  | 20                     | 3666.95  | 35                     | 5691.08  |

## TENSION OF THE VAPOR OF AMMONIA.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 607.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| —38.5                  | 760.00   | —5                     | 2624.22  | 25                     | 7477.00  | 55                     | 17219.78 | 85                     | 34330.87 |
| —30                    | 866.09   | 0                      | 3183.34  | 30                     | 8700.97  | 60                     | 19482.10 | 90                     | 38109.22 |
| —25                    | 1104.28  | +5                     | 3830.34  | 35                     | 10070.18 | 65                     | 21965.13 | 95                     | 42195.71 |
| —20                    | 1392.13  | 10                     | 4574.03  | 40                     | 11595.30 | 70                     | 24675.55 | 100                    | 46608.24 |
| —15                    | 1736.48  | 15                     | 5423.40  | 45                     | 13287.31 | 75                     | 27629.98 |                        |          |
| —10                    | 2144.62  | 20                     | 6387.78  | 50                     | 15158.33 | 80                     | 30843.09 |                        |          |

## TENSION OF THE VAPOR OF SULPHURETTED HYDROGEN.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 616.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| -61.8                  | 760.00   | -5                     | 7066.03  | 15                     | 12447.94 | 35                     | 20224.31 | 55                     | 30690.69 |
| -25                    | 3749.33  | 0                      | 8206.29  | 20                     | 14151.51 | 40                     | 22582.46 | 60                     | 33740.16 |
| -20                    | 4438.45  | +5                     | 9490.80  | 25                     | 16012.39 | 45                     | 24954.26 | 65                     | 36961.55 |
| -15                    | 5196.52  | 10                     | 10896.32 | 30                     | 18035.35 | 50                     | 27814.77 | 70                     | 40353.25 |
| -10                    | 6084.57  |                        |          |                        |          |                        |          |                        |          |

## TENSION OF THE VAPOR OF CARBONIC ACID.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 625.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| 78.2                   | 760.00   | -10                    | 20340.20 | +5                     | 30753.80 | 20                     | 44716.58 | 35                     | 62447.30 |
| -25                    | 13007.02 | -5                     | 23441.34 | 10                     | 34998.65 | 25                     | 50207.32 | 40                     | 69184.45 |
| -20                    | 15142.44 | 0                      | 26906.60 | 15                     | 39646.86 | 30                     | 56119.05 | 45                     | 73314.60 |
| -15                    | 17582.48 |                        |          |                        |          |                        |          |                        |          |

## TENSION OF THE VAPOR OF PROTOXIDE OF NITROGEN.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 631.

| Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. | Tem-<br>pera-<br>ture. | Tension. |
|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|------------------------|----------|
| °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      | °                      | mm.      |
| 87.9                   | 760.00   | -15                    | 19684.33 | 0                      | 27420.97 | 15                     | 37831.66 | 30                     | 51708.55 |
| -25                    | 15694.88 | -10                    | 22008.05 | +5                     | 30558.64 | 20                     | 42027.88 | 35                     | 57268.08 |
| -20                    | 17586.58 | -5                     | 24579.20 | 10                     | 34019.09 | 25                     | 46641.40 | 40                     | 63359.78 |

NOTE. — Tables for tension of vapor of Water and Mercury will be found in the next section.

## TABLE

OF UNITS OF HEAT EVOLVED BY THE COMBINATION OF EQUIVALENTS, IN GRAMMES, OF SOME OF THE ELEMENTS.

*The quantity of Heat necessary to raise 1 gramme of Water at 0° C. one degree, being unity. Hydrogen = 1. Those marked F. S. are by Favre and Silberman, A. by Andrews. Those marked \* were calculated, the others observed.*

MILLER. — Chem. Physics, p. 309.

| Elements.  | Observers. | Oxygen. | Chlorine. | Bromine. | Iodine. | Sulphur. |
|------------|------------|---------|-----------|----------|---------|----------|
| Hydrogen   | F. S.      | 34462   | 23783     | *9322    | *3606   | *2741    |
| Carbon     | F. S.      | 24240   |           |          |         |          |
| Sulphur    | F. S.      | 17760   |           |          |         |          |
| Phosphorus | A.         | 36072   |           |          |         |          |
| Potassium  | A.         |         | 104476    |          |         |          |
| “          | F. S.      |         | *100960   | *90188   | *77268  | *45638   |
| Sodium     | F. S.      |         | 94847     |          |         |          |
| Zinc       | A.         | 42282   | 50658     | 40640    | 26617   |          |
| “          | F. S.      | *42451  | *50296    |          |         | *20940   |
| Iron       | A.         | 33072   | 32695     | 23833    | 8046    |          |
| “          | F. S.      | *37828  | *49651    |          |         | *17753   |
| Tin        | A.         | 33519   | *31722    |          |         |          |
| Arsenic    | A.         |         | 24992     |          |         |          |
| Antimony   | Dulong     | 47000   | A. 30401  |          |         |          |
| Copper     | Dulong     | 19152   | 30404     |          |         |          |
| “          | F. S.      | *21885  | *29524    |          |         | *9133    |
| Lead       | F. S.      | *27675  | *44730    | *32802   | *23208  | *9556    |
| Silver     | F. S.      | *6113   | *34800    | *25618   | *18651  | *5524    |



## HEAT EVOLVED DURING COMBUSTION IN OXYGEN.

*Heat unit = 1 gramme of water at 0° C. raised 1°.*

MILLER. — Chem. Physics, p. 299.

| Substance burned.    | Heat units evolved by combustion of 1 gramme of substance. | Heat units evolved by combination of 1 gramme of Oxygen. | Heat units evolved by 8 grammes (1 eqt.) of Oxygen. | Compound formed.               | Observers. |
|----------------------|------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------|--------------------------------|------------|
| Hydrogen             | 34462                                                      | 4307                                                     | 34462                                               | HO                             | F. & S.*   |
| “                    | 34743                                                      | 4343                                                     | 34743                                               | “                              | Dulong     |
| Carbon               | 8080                                                       | 3030                                                     | 24240                                               | CO <sub>2</sub>                | F. & S.    |
| “                    | 7912                                                       | 6967                                                     | 23736                                               | “                              | Despretz   |
| Sulphur              | 2220                                                       | 2220                                                     | 17760                                               | SO <sub>2</sub>                | F. & S.    |
| “                    | 2307                                                       | 2307                                                     | 18456                                               | “                              | Andrews    |
| “                    | 2601                                                       | 2601                                                     | 20808                                               | “                              | Dulong     |
| Phosphorus           | 5747                                                       | 4509                                                     | 36072                                               | PO <sub>5</sub>                | Andrews    |
| “                    | 5669                                                       | 4394                                                     | 35148                                               | “                              | Abria      |
| Zinc                 | 1301                                                       | 5285                                                     | 42282                                               | ZnO                            | Andrews    |
| “                    | 1298                                                       | 5273                                                     | 42185                                               | “                              | Dulong     |
| Iron                 | 1576                                                       | 4134                                                     | 33072                                               | Fe <sub>3</sub> O <sub>4</sub> | Andrews    |
| “                    | 1702                                                       | 4340                                                     | 34720                                               | “                              | Dulong     |
| Cobalt               | 1080                                                       | 3995                                                     | 31960                                               | ?                              | “          |
| Nickel               | 1006                                                       | 3723                                                     | 29784                                               | NiO                            | “          |
| Tin                  | 1233                                                       | 4545                                                     | 36360                                               | SnO <sub>2</sub>               | “          |
| “                    | 1144                                                       | 4230                                                     | 33519                                               | “                              | Andrews    |
| Antimony             | 961                                                        | 5875                                                     | 47000                                               | SbO <sub>4</sub>               | Dulong     |
| Copper               | 602                                                        | 2394                                                     | 19152                                               | CuO                            | Andrews    |
| “                    | 632                                                        | 2512                                                     | 20096                                               | “                              | Dulong     |
| Carbonic Oxide       | 2634                                                       | 4609                                                     | 36876                                               | CO <sub>2</sub>                | “          |
| “ “                  | 2431                                                       | 4258                                                     | 34034                                               | “                              | Andrews    |
| “ “                  | 2403                                                       | 4205                                                     | 33642                                               | “                              | F. & S.    |
| Protoxide of Tin     | 534                                                        | 4473                                                     | 35784                                               | SnO <sub>2</sub>               | Dulong     |
| “ “                  | 521                                                        | 4349                                                     | 34792                                               | “                              | Andrews    |
| Suboxide of Copper   | 256                                                        | 2288                                                     | 18304                                               | CuO                            | “          |
| “ “                  | 244                                                        | 2185                                                     | 17480                                               | “                              | Dulong     |
| Cyanogen             | 5195                                                       | 4221                                                     | 33768                                               | “                              | “          |
| Marsh Gas            | 13063                                                      | 3266                                                     | 26128                                               |                                | F. & S.    |
| “ “                  | 13185                                                      | 3296                                                     | 26368                                               |                                | Dulong     |
| Olefiant Gas         | 11942                                                      | 3483                                                     | 27864                                               |                                | Andrews    |
| “ “                  | 11858                                                      | 3458                                                     | 27664                                               |                                | F. & S.    |
| “ “                  | 12030                                                      | 3514                                                     | 28112                                               |                                | Dulong     |
| Alcohol              | 6909                                                       | 3311                                                     | 26488                                               |                                | “          |
| “                    | 6850                                                       | 3282                                                     | 26256                                               |                                | Andrews    |
| “                    | 7183                                                       | 3442                                                     | 27536                                               |                                | F. & S.    |
| Ether                | 9027                                                       | 3480                                                     | 27840                                               |                                | “          |
| Olive Oil            | 9862                                                       |                                                          |                                                     |                                | Dulong     |
| Oil of Turpentine    | 10852                                                      | 3294                                                     | 26352                                               |                                | F. & S.    |
| Bisulphide of Carbon | 3401                                                       | 2692                                                     | 21536                                               |                                | “          |

\* F. &amp; S., Favre and Silbermann.





QUANTITIES OF HEAT DISENGAGED BY THE ACTION OF BROMINE  
AND IODINE.

MILLER. — Chem. Physics, p. 300.

| Elements.       | Heat units evolved by combination of 1 gramme of the substance. | Heat units evolved by combination of 1 gramme of Iodine or Bromine. | Heat units evolved by combination of 1 eqt. of Bromine or Iodine. | Compound produced.              | Observer. |
|-----------------|-----------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------|-----------|
| <b>Bromine.</b> |                                                                 |                                                                     |                                                                   |                                 |           |
| Zinc            | 1269                                                            | 508                                                                 | 40640                                                             | ZnBr                            | Andrews   |
| Iron            | 1277                                                            | 298                                                                 | 23833                                                             | Fe <sub>2</sub> Br <sub>3</sub> | "         |
| <b>Iodine.</b>  |                                                                 |                                                                     |                                                                   |                                 |           |
| Zinc            | 819                                                             | 209                                                                 | 26617                                                             | ZnI                             | Andrews   |
| Iron            | 463                                                             | 63                                                                  | 8046                                                              | Fe <sub>2</sub> I <sub>3</sub>  | "         |

QUANTITIES OF HEAT DISENGAGED BY THE ACTION OF CHLORINE.

MILLER. — Chem. Physics, p. 300.

| Elements.  | Heat units evolved by combination of 1 gramme of the Element. | Heat units evolved by combination of 1 gramme of Chlorine. | Heat units evolved by combination of 1 eqt. of Chlorine. | Compound produced.              | Observer. |
|------------|---------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------|---------------------------------|-----------|
| Hydrogen   | 24087                                                         | 678                                                        | 24087                                                    | HCl                             | Abria     |
| "          | 23783                                                         | 670                                                        | 23783                                                    | "                               | F. & S.   |
| Phosphorus | 3422?                                                         | 607                                                        | 21548                                                    | PCl <sub>5</sub> ?              | Andrews   |
| Potassium  | 2655                                                          | 2943                                                       | 104476                                                   | KCl                             | "         |
| Zinc       | 1529                                                          | 1427                                                       | 50658                                                    | ZnCl                            | "         |
| Iron       | 1745                                                          | 921                                                        | 32695                                                    | Fe <sub>2</sub> Cl <sub>3</sub> | "         |
| Tin        | 1079                                                          | 897                                                        | 31722                                                    | SuCl <sub>2</sub>               | "         |
| Antimony   | 707                                                           | 860                                                        | 30401                                                    | SbCl <sub>3</sub>               | "         |
| Arsenic    | 994                                                           | 704                                                        | 24992                                                    | AsCl <sub>3</sub>               | "         |
| Copper     | 961                                                           | 859                                                        | 30494                                                    | CuCl                            | "         |
| Mercury    | ?                                                             | 822                                                        | 29181                                                    | ?                               | "         |

HEAT UNITS EVOLVED BY COMBINATION OF ONE EQUIVALENT OF THE UNDERMENTIONED BASES  
WITH ONE EQUIVALENT OF CERTAIN ACIDS.

MILLER. — Chem. Physics, pp. 310, 311.

| Acid         | Observers. | Potassium. | Sodium. | Ammonium. | Magnesium. | Zinc. | Manganese. | Nickel. | Cobalt. | Iron (ferrous). | Copper. |
|--------------|------------|------------|---------|-----------|------------|-------|------------|---------|---------|-----------------|---------|
| Sulphuric    | F. & S.    | 16083      | 15810   | 14690     | 14440      | 10455 | 12075      | 11932   | 11780   | 10872           | 7720    |
| "            | A.         | 15900      | 16200   | 13900     | 18500      | 11800 |            |         |         |                 |         |
| Nitric       | F. & S.    | 15510      | 15283   | 13676     | 12840      | 8323  | 10850      | 10450   | 9956    | 9648            | 6400    |
| "            | A.         | 14600      | 14000   | 12200     | 17700      | 10300 |            |         |         |                 |         |
| Phosphoric   | F. & S.    | 17766      |         |           |            |       |            |         |         |                 |         |
| "            | A.         | 14200      | 14000   |           |            |       |            |         |         |                 |         |
| Arsenic      | A.         | 14100      | 13900   | 12200     |            |       |            |         |         |                 |         |
| Hydrochloric | A.         | 14300      | 14700   | 12200     | 17700      | 10600 |            |         |         |                 |         |
| "            | F. & S.    | 15656      | 15128   | 13536     | 13220      | 8307  | 11235      | 10412   | 10374   | 9828            | 6416    |
| Hydrobromic  | F. & S.    | 15510      | 15159   |           |            |       |            |         |         |                 |         |
| Hydriodic    | F. & S.    | 15698      | 15097   |           |            |       |            |         |         |                 |         |
| "            | A.         | 14200      | 14100   | 14700     | 11900      | 9800  |            |         |         |                 |         |
| Oxalic       | A.         | 14400      | 14600   | 12400     |            |       |            |         |         |                 |         |
| "            | F. & S.    | 14156      | 13752   |           |            |       |            |         |         |                 |         |
| Acetic       | F. & S.    | 13973      | 13600   | 12649     | 12270      | 7720  | 9982       | 9245    | 9272    | 8590            | 5264    |
| Formic       | F. & S.    |            | 13308   |           |            |       |            |         |         |                 |         |
| "            | A.         | 13900      |         |           |            |       |            |         |         |                 |         |
| Tartaric     | A.         | 13200      | 12900   | 11200     |            |       |            |         |         |                 |         |
| "            | F. & S.    | 13425      | 12651   |           |            |       |            |         |         |                 |         |
| Citric       | A.         | 13200      | 12900   | 11000     |            |       |            |         |         |                 |         |
| "            | F. & S.    | 13658      | 13178   |           |            |       |            |         |         |                 |         |
| Succinic     | A.         | 13400      | 12900   | 11200     |            |       |            |         |         |                 |         |

F. & S., Favre and Silbermann; A., Andrews.

T A B L E S  
FOR GAS ANALYSIS.



## FORMULAS

## FOR THE WEIGHTS, VOLUMES, AND DENSITIES OF GASES.

Volume of a gas at 0° C. and 760 mm. when its volume at a given temperature and pressure is known.

$$V^0 = V' \frac{1}{1 + 0.00367t} \times \frac{h}{760}.$$

$V^0$  = volume at 0° C. 760 mm.,

$V'$  = the observed volume,

$h$  = “ “ pressure in mm. of mercury reduced to 0° C.

Density at 0° C. and 760 mm. when the density at a given temperature and pressure is known.

$$D^0 = D' (1 + 0.00367t) \frac{760}{h}.$$

$D^0$  = density at 0° C. and 760 mm.,

$D'$  = observed density.

To determine the density of a gas or vapor by Gay-Lussac's method.

$$D = \frac{w}{0.001293 V \frac{1}{1 + 0.00367t}} \times \frac{h}{760}.$$

$w$  = the weight of the vapor,

$V$  = the observed volume,

$h$  = “ “ pressure in mm. of mercury at 0° C.,

$t$  = temperature of the vapor,

0.001293 = weight of 1 cubic centimetre of air at 0° C. and 760 mm.

To determine the density of a vapor by Dumas's method.

$$D = \frac{W' - (W - w)}{0.001293 V \frac{1}{1 + 0.00367t}} \times \frac{h}{760}.$$

When there is an air bubble

$$D = \frac{W' - (W - w) - w'}{0.001293 (V - v') \frac{1}{1 + 0.00367t}} \times \frac{h}{760}.$$

In which formulas

$$w = 0.001293 V \frac{1}{1 + 0.00367 t} \times \frac{h'}{760}.$$

$$w' = 0.001293 (V - V') \frac{1}{1 + 0.00367 t''} \times \frac{h''}{760}.$$

$$v' = (V - V') \frac{1 + 0.00367 t'}{1 + 0.00367 t''} \times \frac{h''}{h}.$$

$w$  = weight of air in balloon when first weighed,

$w'$  = weight of air bubble,

$v'$  = volume of air bubble.

$W$  = weight of balloon filled with air,

$t$  = temperature at moment of weighing,

$h'$  = the height of the barometer,

$t'$  = temperature at moment of sealing,

$h$  = height of barometer at moment of sealing,

$W'$  = weight of balloon filled with vapor,

$V$  = capacity of balloon in cubic centimetres,

$V'$  = the volume of water or mercury which enters the balloon.

$(V - V')$  = volume of air bubble,

$t''$  = the temperature during this determination,

$h''$  = pressure on enclosed bubble of air.

In almost all cases the factors into which the pressures enter may be neglected, since they may be regarded as constant during the experiment.

If the expansion of the glass is allowed for, the formula becomes

$$D = \frac{W' - (W - w) - w'}{0.0012932 (Va - v) \frac{1}{1 + 0.00367 t'} \times \frac{h}{760}}.$$

In which,  $a = 1 + k (t' - t'')$ ,  $k$  being the coefficient of expansion of the glass.

The above formula may be written

$$D = \frac{W' - W + (A \times V \times h') - (A \times (V - V') \times h'')}{\left[ Va - (V - V') B (t' - t'') \frac{h''}{h} \right] A' \times h}$$

$$A = \frac{0.0012932}{760 (1 + 0.00367 t)}.$$

$$B = 1 + \frac{0.00367}{1 + 0.00367 t''}.$$



$$A' = \frac{0.0012932}{760 (1 + 0.00367 t)}. \quad a = 1 + k (t' - t'').$$

Which values will be found in the tables. Generally  $\frac{h''}{h'}$  and  $a$  may be neglected, as they are very small.

Deville and Troost use the following constants in determining vapor densities.

|                          | °C.  |
|--------------------------|------|
| Vapor of Boiling Mercury | 350  |
| “ “ “ Sulphur            | 440  |
| “ “ “ Cadmium            | 860  |
| “ “ “ Zinc               | 1040 |

The foregoing formulas by the use of logarithms become

For volume of a gas

$$\text{Log } V^0 = \text{Log } V' + \text{Log } \frac{1}{1 + 0.00367 t} + \text{Log } \frac{h}{760}.$$

$$\text{For Logs of } \frac{1}{1 + 0.00367 t} \text{ and } \text{Log } \frac{h}{760} \text{ see Tables.}$$

For weight

$$\text{Log weight} = \text{Log } w + \text{Log } V' + \text{Log } \frac{1}{1 + 0.00367 t} + \text{Log } \frac{h}{760}.$$

$w$  = weight of one cubic centimetre of the gas. (Page 93.)

For the density of a gas at 0° C. and 760 mm.

$$\text{Log } D^0 = \text{Log } D' + \text{Log } (1 + 0.00367 t) + \text{Log } 760 - \text{Log } h,$$

$$\text{Log } 760 = 2.88081.$$

For the density of a vapor by Gay-Lussac's method

$$\text{Log } D = \text{Log } w - \left[ \text{Log } 0.001293 + \text{Log } V' + \text{Log } \left( \frac{1}{1 + 0.00367 t} \right) + \text{Log } \left( \frac{h}{760} \right) \right].$$

$$\text{Log } .001293 = 7.11166.$$

For the density of a vapor by Dumas's method

$$\begin{aligned} \text{Log } D = \text{Log } [W' - (W - w)] - \left[ \text{Log } 0.001293 + \text{Log } V \right. \\ \left. + \text{Log } \left( \frac{1}{1 + 0.00367 t'} \right) + \text{Log } \left( \frac{h}{760} \right) \right]. \end{aligned}$$

When there is an air bubble

$$\begin{aligned} \text{Log } D = \text{Log } [W' - (W - w) - w'] - \left[ \text{Log } 0.001293 + \text{Log } (V - v') \right. \\ \left. + \text{Log } \left( \frac{1}{1 + 0.00367 t'} \right) + \text{Log } \left( \frac{h}{760} \right) \right]. \end{aligned}$$

$$\text{Log } w = \text{Log } 0.001293 + \text{Log } V + \text{Log } \left( \frac{1}{1 + 0.00367 t} \right) + \text{Log } \left( \frac{h'}{760} \right).$$

$$\begin{aligned} \text{Log } w' = \text{Log } 0.001293 + \text{Log } (V - V') + \text{Log } \left( \frac{1}{1 + 0.00367 t''} \right) \\ + \text{Log } \left( \frac{h''}{760} \right). \end{aligned}$$

$$\begin{aligned} \text{Log } v' = \text{Log } (V - V') + \text{Log } (1 + 0.00367 t') + \text{Log } h'' \\ + \text{Log } \left( \frac{1}{1 + 0.00367 t''} \right) + \text{Log } \left( \frac{1}{h} \right). \end{aligned}$$

In most cases it will be sufficient to take the value of  $h$  to the nearest millimetre.

TABLE  
OF PHYSICAL PROPERTIES OF SOME OF THE MOST COMMON GASES.

REGNAULT. — Mémoires de l'Académie Royale de France, Tome XXI.

| Name.                    | Density.                   |                              | Coefficients of Expansion for 100° C. |                       | Weight of 1 cc.<br>0° C. 760 m. | Log. of the weight<br>of 1 cc. of the gas. |
|--------------------------|----------------------------|------------------------------|---------------------------------------|-----------------------|---------------------------------|--------------------------------------------|
|                          | Air = 1<br>at 0° C. 760 m. | Water = 1<br>at 4° C. 760 m. | Constant<br>Volume.                   | Constant<br>Pressure. |                                 |                                            |
| Air                      | 1.00000                    | 0.001293187                  | 0.3665                                | 0.3670                | 0.001293187                     | 7.11166                                    |
| Hydrogen                 | 0.06926                    | 0.000089578                  | 0.3667                                | 0.3661                | 0.000089578                     | 5.95220                                    |
| Nitrogen                 | 0.97200                    | 0.001256167                  | 0.3668                                | 0.3670                | 0.001256167                     | 7.09905                                    |
| Oxygen                   | 1.10570                    | 0.001429802                  | 0.3667                                | 0.3669                | 0.001529802                     | 7.18464                                    |
| Carbonic oxide<br>" acid | 1.52901                    | 0.001977414                  | 0.3688                                | 0.3710                | 0.001977414                     | 7.29611                                    |
| Protoxide of Nitrogen    |                            |                              | 0.3676                                | 0.3719                |                                 |                                            |
| Sulphurous acid          |                            |                              | 0.3845                                | 0.3903                |                                 |                                            |
| Cyanogen                 |                            |                              | 0.3829                                | 0.3877                |                                 |                                            |

LOGARITHMS OF  $\frac{h}{760}$ 

| Centi-<br>metres. | Millimetres. |         |         |         |         |
|-------------------|--------------|---------|---------|---------|---------|
|                   | 0            | 1       | 2       | 3       | 4       |
| 0                 |              | 7.11919 | 7.42022 | 7.59631 | 7.72125 |
| 1                 | 8.11919      | 8.16058 | 8.19837 | 8.23313 | 8.26531 |
| 2                 | .42022       | .44141  | .46161  | .48091  | .49940  |
| 3                 | .59631       | .61055  | .62434  | .63770  | .65067  |
| 4                 | .72125       | .73197  | .74244  | .75265  | .76264  |
| 5                 | .81816       | .82676  | .83519  | .84346  | .85158  |
| 6                 | .89734       | .90452  | .91158  | .91853  | .92537  |
| 7                 | .96428       | .97043  | .97652  | .98251  | .98841  |
| 8                 | 9.02228      | 9.02767 | 9.03300 | 9.03826 | 9.04346 |
| 9                 | .07343       | .07823  | .08297  | .08769  | .09231  |
| 10                | .11919       | .12351  | .12779  | .13202  | .13622  |
| 11                | .16058       | .16451  | .16840  | .17226  | .17609  |
| 12                | .19837       | .20197  | .20555  | .20909  | .21261  |
| 13                | .23313       | .23646  | .23976  | .24304  | .24629  |
| 14                | .26531       | .26841  | .27147  | .27452  | .27755  |
| 15                | .29528       | .29816  | .30103  | .30388  | .30671  |
| 16                | .32331       | .32601  | .32870  | .33137  | .33403  |
| 17                | .34964       | .35218  | .35471  | .35723  | .35974  |
| 18                | .37446       | .37687  | .37926  | .38164  | .38400  |
| 19                | .39794       | .40022  | .40249  | .40474  | .40699  |
| 20                | .42022       | .42238  | .42454  | .42668  | .42882  |
| 21                | .44141       | .44347  | .44552  | .44757  | .44960  |
| 22                | .46161       | .46358  | .46554  | .46749  | .46943  |
| 23                | .48091       | .48280  | .48467  | .48654  | .48840  |
| 24                | .49940       | .50120  | .50300  | .50479  | .50658  |
| 25                | .51713       | .51886  | .52059  | .52231  | .52402  |
| 26                | .53416       | .53583  | .53749  | .53914  | .54079  |
| 27                | .55055       | .55216  | .55376  | .55535  | .55694  |
| 28                | .56634       | .56789  | .56944  | .57097  | .57250  |
| 29                | .58158       | .58308  | .58457  | .58605  | .58753  |
| 30                | .59631       | .59775  | .59919  | .60063  | .60206  |
| 31                | .61055       | .61195  | .61334  | .61473  | .61612  |
| 32                | .62434       | .62569  | .62704  | .62839  | .62973  |
| 33                | .63770       | .63901  | .64032  | .64163  | .64293  |
| 34                | .65067       | .65194  | .65321  | .65448  | .65574  |

FROM  $h = 1$  TO  $h = 699$ .

| Centi-<br>metres. | Millimetres. |         |         |         |         |
|-------------------|--------------|---------|---------|---------|---------|
|                   | 5            | 6       | 7       | 8       | 9       |
| 0                 | 7.81816      | 7.89734 | 7.96428 | 8.02228 | 8.07343 |
| 1                 | 8.29538      | 8.32331 | 8.34964 | .37446  | .39794  |
| 2                 | .51713       | .53416  | .55055  | .56634  | .58158  |
| 3                 | .66325       | .67549  | .68739  | .69897  | .71025  |
| 4                 | .77240       | .78194  | .79128  | .80043  | .80938  |
| 5                 | .85956       | .86737  | .87506  | .88261  | .89004  |
| 6                 | .93210       | .93873  | .94526  | .95169  | .95804  |
| 7                 | .99425       | 9.00000 | 9.00568 | 9.01128 | 9.01681 |
| 8                 | 9.04860      | .05368  | .05871  | .06367  | .06858  |
| 9                 | .09691       | .10145  | .10596  | .11041  | .11482  |
| 10                | .14038       | .14449  | .14857  | .15261  | .15661  |
| 11                | .17988       | .18364  | .18737  | .19107  | .19473  |
| 12                | .21610       | .21956  | .22299  | .22640  | .22978  |
| 13                | .24952       | .25273  | .25591  | .25907  | .26220  |
| 14                | .28055       | .28354  | .28650  | .28945  | .29237  |
| 15                | .30952       | .31231  | .31509  | .31784  | .32058  |
| 16                | .33667       | .33929  | .34190  | .34450  | .34707  |
| 17                | .36222       | .36470  | .36716  | .36961  | .37204  |
| 18                | .38636       | .38870  | .39103  | .39334  | .39565  |
| 19                | .40922       | .41144  | .41365  | .41585  | .41804  |
| 20                | .43094       | .43305  | .43516  | .43725  | .43933  |
| 21                | .45162       | .45364  | .45565  | .45764  | .45963  |
| 22                | .47137       | .47329  | .47521  | .47712  | .47902  |
| 23                | .49025       | .49210  | .49393  | .49576  | .49758  |
| 24                | .50835       | .51012  | .51188  | .51364  | .51539  |
| 25                | .52573       | .52743  | .52912  | .53081  | .53249  |
| 26                | .54243       | .54407  | .54570  | .54732  | .54894  |
| 27                | .55852       | .56010  | .56167  | .56323  | .56479  |
| 28                | .57403       | .57555  | .57707  | .57858  | .58008  |
| 29                | .58901       | .59048  | .59194  | .59340  | .59486  |
| 30                | .60349       | .60491  | .60632  | .60774  | .60914  |
| 31                | .61750       | .61887  | .62025  | .62161  | .62298  |
| 32                | .63107       | .63240  | .63373  | .63506  | .63638  |
| 33                | .64423       | .64553  | .64682  | .64810  | .64939  |
| 34                | .65701       | .65826  | .65952  | .66077  | .66201  |

| Centi-<br>metres. | Millimetres. |         |         |         |         |
|-------------------|--------------|---------|---------|---------|---------|
|                   | 0            | 1       | 2       | 3       | 4       |
| 35                | 9.66325      | 9.66449 | 9.66573 | 9.66696 | 9.66819 |
| 36                | .67549       | .67669  | .67790  | .67909  | .68029  |
| 37                | .68739       | .68856  | .68973  | .69090  | .69206  |
| 38                | .69897       | .70011  | .70125  | .70239  | .70352  |
| 39                | .71025       | .71136  | .71247  | .71358  | .71468  |
| 40                | .72125       | .72233  | .72341  | .72449  | .72556  |
| 41                | .73197       | .73303  | .73408  | .73514  | .73619  |
| 42                | .74244       | .74347  | .74450  | .74553  | .74655  |
| 43                | .75265       | .75366  | .75467  | .75567  | .75668  |
| 44                | .76264       | .76363  | .76461  | .76559  | .76657  |
| 45                | .77240       | .77336  | .77432  | .77528  | .77624  |
| 46                | .78194       | .78289  | .78383  | .78477  | .78570  |
| 47                | .79128       | .79221  | .79313  | .79405  | .79496  |
| 48                | .80043       | .80133  | .80223  | .80313  | .80403  |
| 49                | .80938       | .81027  | .81115  | .81203  | .81291  |
| 50                | .81816       | .81902  | .81989  | .82075  | .82162  |
| 51                | .82676       | .82761  | .82846  | .82930  | .83015  |
| 52                | .83519       | .83602  | .83686  | .83769  | .83852  |
| 53                | .84346       | .84428  | .84510  | .84591  | .84673  |
| 54                | .85158       | .85238  | .85319  | .85399  | .85479  |
| 55                | .85955       | .86034  | .86113  | .86191  | .86270  |
| 56                | .86737       | .86815  | .86892  | .86969  | .87047  |
| 57                | .87506       | .87582  | .87658  | .87734  | .87810  |
| 58                | .88261       | .88336  | .88411  | .88486  | .88560  |
| 59                | .89004       | .89077  | .89151  | .89224  | .89297  |
| 60                | .89734       | .89806  | .89878  | .89950  | .90022  |
| 61                | .90452       | .90523  | .90594  | .90665  | .90735  |
| 62                | .91158       | .91228  | .91298  | .91367  | .91437  |
| 63                | .91853       | .91922  | .91990  | .92059  | .92128  |
| 64                | .92537       | .92604  | .92672  | .92740  | .92807  |
| 65                | .93210       | .93277  | .93343  | .93410  | .93476  |
| 66                | .93873       | .93939  | .94004  | .94070  | .94135  |
| 67                | .94526       | .94591  | .94656  | .94720  | .94785  |
| 68                | .95170       | .95233  | .95297  | .95361  | .95424  |
| 69                | .95804       | .95866  | .95929  | .95992  | .96055  |



| Centi-<br>metres. | Millimetres. |         |         |         |         |
|-------------------|--------------|---------|---------|---------|---------|
|                   | 5            | 6       | 7       | 8       | 9       |
| 35                | 9.66941      | 9.67064 | 9.67185 | 9.67307 | 9.67428 |
| 36                | .68148       | .68267  | .68385  | .68503  | .68621  |
| 37                | .69322       | .69437  | .69553  | .69668  | .69783  |
| 38                | .70465       | .70577  | .70690  | .70802  | .70914  |
| 39                | .71578       | .71688  | .71798  | .71907  | .72016  |
| 40                | .72664       | .72771  | .72878  | .72985  | .73091  |
| 41                | .73723       | .73828  | .73932  | .74036  | .74140  |
| 42                | .74758       | .74860  | .74961  | .75063  | .75164  |
| 43                | .75768       | .75867  | .75967  | .76066  | .76165  |
| 44                | .76755       | .76852  | .76949  | .77046  | .77143  |
| 45                | .77720       | .77815  | .77910  | .78005  | .78100  |
| 46                | .78664       | .78757  | .78850  | .78943  | .79036  |
| 47                | .79588       | .79679  | .79770  | .79861  | .79952  |
| 48                | .80493       | .80582  | .80672  | .80760  | .80850  |
| 49                | .81379       | .81467  | .81554  | .81642  | .81729  |
| 50                | .82248       | .82334  | .82419  | .82505  | .82590  |
| 51                | .83099       | .83184  | .83268  | .83352  | .83435  |
| 52                | .83935       | .84017  | .84100  | .84182  | .84264  |
| 53                | .84754       | .84835  | .84916  | .84997  | .85078  |
| 54                | .85558       | .85638  | .85717  | .85797  | .85876  |
| 55                | .86348       | .86426  | .86504  | .86582  | .86660  |
| 56                | .87123       | .87200  | .87277  | .87353  | .87430  |
| 57                | .87885       | .87961  | .88036  | .88111  | .88187  |
| 58                | .88634       | .88708  | .88782  | .88856  | .88930  |
| 59                | .89370       | .89443  | .89516  | .89589  | .89661  |
| 60                | .90094       | .90166  | .90238  | .90309  | .90380  |
| 61                | .90806       | .90877  | .90947  | .91017  | .91088  |
| 62                | .91507       | .91576  | .91645  | .91715  | .91784  |
| 63                | .92196       | .92264  | .92333  | .92401  | .92469  |
| 64                | .92875       | .92942  | .93009  | .93076  | .93143  |
| 65                | .93543       | .93609  | .93675  | .93741  | .93807  |
| 66                | .94201       | .94266  | .94331  | .94396  | .94461  |
| 67                | .94849       | .94913  | .94978  | .95042  | .95106  |
| 68                | .95488       | .95551  | .95614  | .95677  | .95741  |
| 69                | .96117       | .96180  | .96242  | .96304  | .96366  |

BAROMETRICAL CORRECTION. LOGARITHMS OF  $\frac{h}{760}$ .

| Milli-<br>metres. | Tenths of Millimetres. |     |     |      |      |      |      |      |      |      |
|-------------------|------------------------|-----|-----|------|------|------|------|------|------|------|
|                   | 0.0                    | 0.1 | 0.2 | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 700               | 9.96428                | 434 | 441 | 447  | 453  | 459  | 465  | 472  | 478  | 484  |
| 701               | 490                    | 496 | 503 | 509  | 515  | 521  | 527  | 534  | 540  | 546  |
| 702               | 552                    | 558 | 565 | 571  | 577  | 583  | 589  | 596  | 602  | 608  |
| 703               | 614                    | 620 | 626 | 632  | 639  | 645  | 651  | 657  | 663  | 670  |
| 704               | 676                    | 682 | 688 | 694  | 701  | 707  | 713  | 719  | 725  | 731  |
| 705               | 737                    | 743 | 749 | 755  | 762  | 768  | 774  | 780  | 786  | 793  |
| 706               | 799                    | 805 | 811 | 817  | 823  | 829  | 836  | 842  | 848  | 854  |
| 707               | 860                    | 866 | 872 | 878  | 884  | 890  | 896  | 903  | 909  | 915  |
| 708               | 922                    | 928 | 934 | 940  | 946  | 952  | 958  | 964  | 970  | 976  |
| 709               | 982                    | 988 | 994 | *001 | *007 | *013 | *019 | *025 | *021 | *038 |
| 710               | 9.97044                | 050 | 056 | 062  | 068  | 074  | 081  | 087  | 093  | 099  |
| 711               | 105                    | 111 | 117 | 124  | 130  | 136  | 142  | 148  | 154  | 160  |
| 712               | 166                    | 172 | 178 | 185  | 191  | 197  | 203  | 209  | 215  | 221  |
| 713               | 227                    | 233 | 239 | 246  | 252  | 258  | 264  | 270  | 276  | 282  |
| 714               | 288                    | 294 | 300 | 307  | 313  | 319  | 325  | 331  | 337  | 343  |
| 715               | 349                    | 355 | 361 | 367  | 373  | 379  | 385  | 391  | 397  | 404  |
| 716               | 410                    | 416 | 422 | 428  | 434  | 440  | 446  | 452  | 458  | 464  |
| 717               | 470                    | 476 | 482 | 488  | 494  | 500  | 506  | 513  | 519  | 525  |
| 718               | 531                    | 537 | 543 | 549  | 555  | 561  | 567  | 573  | 579  | 585  |
| 719               | 591                    | 597 | 603 | 609  | 615  | 621  | 627  | 633  | 639  | 645  |
| 720               | 651                    | 657 | 663 | 669  | 675  | 681  | 687  | 693  | 699  | 705  |
| 721               | 711                    | 717 | 723 | 729  | 735  | 742  | 748  | 754  | 760  | 766  |
| 722               | 772                    | 778 | 784 | 790  | 796  | 802  | 808  | 814  | 820  | 826  |
| 723               | 832                    | 838 | 844 | 850  | 856  | 862  | 868  | 874  | 880  | 886  |
| 724               | 892                    | 898 | 904 | 910  | 916  | 922  | 928  | 934  | 940  | 946  |
| 725               | 952                    | 958 | 964 | 970  | 976  | 982  | 988  | 994  | *000 | *006 |
| 726               | 9.98012                | 018 | 024 | 030  | 036  | 042  | 048  | 054  | 060  | 066  |
| 727               | 072                    | 078 | 084 | 090  | 096  | 102  | 108  | 114  | 120  | 126  |
| 728               | 132                    | 138 | 144 | 150  | 156  | 162  | 168  | 173  | 179  | 185  |
| 729               | 191                    | 197 | 203 | 209  | 215  | 221  | 227  | 233  | 239  | 245  |
| 730               | 251                    | 257 | 263 | 269  | 275  | 280  | 286  | 292  | 298  | 304  |
| 731               | 310                    | 316 | 322 | 328  | 334  | 340  | 346  | 352  | 358  | 364  |
| 732               | 370                    | 376 | 381 | 387  | 393  | 399  | 405  | 411  | 417  | 423  |
| 733               | 429                    | 435 | 441 | 447  | 453  | 458  | 464  | 470  | 476  | 482  |
| 734               | 488                    | 494 | 500 | 506  | 512  | 518  | 524  | 530  | 535  | 541  |
| 735               | 547                    | 553 | 559 | 565  | 571  | 577  | 583  | 589  | 595  | 601  |
| 736               | 607                    | 612 | 618 | 624  | 630  | 636  | 642  | 648  | 653  | 659  |
| 737               | 665                    | 671 | 677 | 683  | 689  | 695  | 701  | 706  | 712  | 718  |
| 738               | 724                    | 730 | 736 | 742  | 748  | 754  | 760  | 765  | 771  | 777  |
| 739               | 783                    | 789 | 795 | 801  | 806  | 812  | 818  | 824  | 830  | 836  |

| Milli-<br>metres. | Tenths of Millimetres. |     |     |     |     |     |     |      |      |      |
|-------------------|------------------------|-----|-----|-----|-----|-----|-----|------|------|------|
|                   | 0.0                    | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7  | 0.8  | 0.9  |
| 740               | 9.98842                | 848 | 854 | 860 | 866 | 872 | 877 | 883  | 889  | 895  |
| 741               | 901                    | 907 | 913 | 918 | 924 | 930 | 936 | 942  | 948  | 954  |
| 742               | 959                    | 965 | 971 | 977 | 983 | 989 | 994 | *000 | *006 | *012 |
| 743               | 9.99018                | 024 | 030 | 035 | 041 | 047 | 053 | 059  | 065  | 070  |
| 744               | 076                    | 082 | 088 | 094 | 100 | 105 | 111 | 117  | 123  | 129  |
| 745               | 135                    | 140 | 146 | 152 | 158 | 164 | 170 | 175  | 181  | 187  |
| 746               | 193                    | 199 | 205 | 210 | 216 | 222 | 228 | 234  | 239  | 245  |
| 747               | 251                    | 257 | 263 | 268 | 274 | 280 | 286 | 292  | 298  | 303  |
| 748               | 309                    | 315 | 321 | 327 | 332 | 338 | 344 | 350  | 356  | 361  |
| 749               | 367                    | 373 | 379 | 385 | 390 | 396 | 402 | 408  | 414  | 419  |
| 750               | 425                    | 431 | 437 | 442 | 448 | 454 | 460 | 466  | 471  | 477  |
| 751               | 483                    | 489 | 495 | 500 | 506 | 512 | 518 | 523  | 529  | 535  |
| 752               | 541                    | 547 | 552 | 558 | 564 | 570 | 575 | 581  | 587  | 593  |
| 753               | 598                    | 604 | 610 | 616 | 622 | 627 | 633 | 639  | 645  | 650  |
| 754               | 656                    | 662 | 668 | 673 | 679 | 685 | 691 | 696  | 702  | 708  |
| 755               | 714                    | 719 | 725 | 731 | 737 | 742 | 748 | 754  | 760  | 765  |
| 756               | 771                    | 777 | 783 | 788 | 794 | 800 | 806 | 811  | 817  | 823  |
| 757               | 829                    | 834 | 840 | 846 | 852 | 857 | 863 | 869  | 874  | 880  |
| 758               | 886                    | 892 | 897 | 903 | 909 | 915 | 920 | 926  | 932  | 937  |
| 759               | 943                    | 949 | 955 | 960 | 966 | 972 | 977 | 983  | 989  | 995  |
| 760               | 0.00000                | 006 | 012 | 017 | 023 | 029 | 035 | 040  | 046  | 052  |
| 761               | 057                    | 063 | 069 | 075 | 080 | 086 | 092 | 097  | 103  | 109  |
| 762               | 114                    | 120 | 126 | 132 | 137 | 143 | 149 | 154  | 160  | 166  |
| 763               | 171                    | 177 | 183 | 189 | 194 | 200 | 206 | 211  | 217  | 223  |
| 764               | 228                    | 234 | 240 | 245 | 251 | 257 | 262 | 268  | 274  | 279  |
| 765               | 285                    | 291 | 296 | 302 | 308 | 314 | 319 | 325  | 331  | 336  |
| 766               | 342                    | 348 | 353 | 359 | 365 | 370 | 376 | 382  | 387  | 393  |
| 767               | 399                    | 404 | 410 | 416 | 421 | 427 | 432 | 438  | 444  | 449  |
| 768               | 455                    | 461 | 466 | 472 | 478 | 483 | 489 | 495  | 500  | 506  |
| 769               | 512                    | 517 | 523 | 529 | 534 | 540 | 546 | 551  | 557  | 562  |
| 770               | 568                    | 573 | 579 | 584 | 590 | 596 | 601 | 607  | 612  | 618  |
| 771               | 624                    | 629 | 635 | 641 | 646 | 652 | 657 | 663  | 669  | 674  |
| 772               | 680                    | 686 | 691 | 697 | 703 | 708 | 714 | 719  | 725  | 731  |
| 773               | 736                    | 742 | 747 | 753 | 758 | 764 | 770 | 776  | 781  | 787  |
| 774               | 793                    | 798 | 804 | 809 | 815 | 821 | 826 | 832  | 837  | 843  |
| 775               | 849                    | 854 | 860 | 865 | 871 | 877 | 882 | 888  | 894  | 899  |
| 776               | 905                    | 910 | 916 | 921 | 927 | 934 | 938 | 944  | 949  | 955  |
| 777               | 961                    | 966 | 972 | 978 | 983 | 989 | 994 | *000 | *006 | *011 |
| 778               | 0.01017                | 022 | 028 | 033 | 039 | 044 | 050 | 056  | 061  | 067  |
| 779               | 072                    | 078 | 083 | 089 | 095 | 100 | 106 | 111  | 117  | 123  |
| 780               | 128                    | 134 | 139 | 145 | 150 | 156 | 162 | 167  | 173  | 178  |

TABLE OF LOG  $\frac{1}{1 + 0.00367t}$ .

| t  | Tenths of Degrees. |     |     |      |      |      |      |      |      |      |
|----|--------------------|-----|-----|------|------|------|------|------|------|------|
|    | 0.0                | 0.1 | 0.2 | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 0  |                    | 984 | 968 | 952  | 936  | 920  | 904  | 888  | 872  | 857  |
| 1  | 9.99841            | 825 | 809 | 793  | 777  | 762  | 746  | 730  | 714  | 698  |
| 2  | 683                | 667 | 651 | 635  | 619  | 604  | 588  | 572  | 556  | 541  |
| 3  | 525                | 509 | 493 | 478  | 462  | 446  | 430  | 415  | 399  | 383  |
| 4  | 368                | 352 | 336 | 321  | 305  | 289  | 274  | 258  | 242  | 227  |
| 5  | 211                | 196 | 180 | 164  | 149  | 133  | 117  | 102  | 086  | 071  |
| 6  | 055                | 040 | 024 | 008  | *993 | *977 | *962 | *946 | *931 | *915 |
| 7  | 9.98900            | 884 | 869 | 853  | 838  | 822  | 807  | 791  | 776  | 760  |
| 8  | 745                | 729 | 714 | 698  | 683  | 668  | 652  | 637  | 621  | 606  |
| 9  | 590                | 575 | 560 | 544  | 529  | 514  | 498  | 483  | 467  | 452  |
| 10 | 437                | 421 | 406 | 391  | 375  | 360  | 345  | 329  | 314  | 299  |
| 11 | 283                | 268 | 253 | 238  | 222  | 207  | 192  | 177  | 161  | 146  |
| 12 | 131                | 116 | 100 | 085  | 070  | 055  | 039  | 024  | 009  | *994 |
| 13 | 9.97979            | 963 | 948 | 933  | 918  | 903  | 888  | 872  | 857  | 842  |
| 14 | 827                | 812 | 797 | 782  | 766  | 751  | 736  | 721  | 706  | 691  |
| 15 | 676                | 661 | 646 | 631  | 616  | 600  | 585  | 570  | 555  | 540  |
| 16 | 525                | 510 | 495 | 480  | 465  | 450  | 435  | 420  | 405  | 390  |
| 17 | 375                | 360 | 345 | 330  | 315  | 300  | 285  | 270  | 255  | 241  |
| 18 | 226                | 211 | 196 | 181  | 166  | 151  | 136  | 121  | 106  | 091  |
| 19 | 076                | 062 | 047 | 032  | 017  | 002  | *987 | *972 | *958 | *943 |
| 20 | 9.96928            | 913 | 898 | 883  | 869  | 854  | 839  | 824  | 809  | 795  |
| 21 | 780                | 765 | 750 | 735  | 721  | 706  | 691  | 676  | 662  | 647  |
| 22 | 632                | 618 | 603 | 588  | 573  | 559  | 544  | 529  | 515  | 500  |
| 23 | 485                | 471 | 456 | 441  | 426  | 412  | 397  | 383  | 368  | 353  |
| 24 | 339                | 324 | 309 | 295  | 280  | 266  | 251  | 237  | 222  | 207  |
| 25 | 188                | 174 | 159 | 145  | 130  | 116  | 101  | 087  | 072  | 057  |
| 26 | 042                | 028 | 013 | *999 | *984 | *970 | *955 | *941 | *926 | *912 |
| 27 | 9.95897            | 883 | 868 | 854  | 839  | 825  | 810  | 796  | 781  | 767  |
| 28 | 752                | 738 | 723 | 709  | 694  | 680  | 665  | 651  | 636  | 622  |
| 29 | 607                | 593 | 578 | 564  | 549  | 535  | 520  | 506  | 491  | 477  |
| 30 | 463                | 449 | 434 | 420  | 406  | 391  | 377  | 363  | 348  | 334  |
| 31 | 320                | 306 | 292 | 277  | 263  | 249  | 234  | 220  | 206  | 191  |
| 32 | 177                | 163 | 149 | 134  | 120  | 106  | 092  | 078  | 063  | 049  |
| 33 | 035                | 021 | 007 | *993 | *978 | *964 | *950 | *935 | *921 | *907 |
| 34 | 9.94893            | 879 | 865 | 851  | 837  | 822  | 808  | 794  | 780  | 766  |



| t               | Tenths of Degrees. |     |      |      |      |      |      |      |      |      |
|-----------------|--------------------|-----|------|------|------|------|------|------|------|------|
|                 | 0.0                | 0.1 | 0.2  | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 35 <sup>o</sup> | 9.94752            | 738 | 724  | 710  | 695  | 681  | 667  | 653  | 639  | 625  |
| 36              | 611                | 597 | 583  | 569  | 554  | 540  | 526  | 512  | 498  | 484  |
| 37              | 470                | 456 | 442  | 428  | 414  | 400  | 386  | 372  | 358  | 344  |
| 38              | 330                | 316 | 302  | 288  | 274  | 260  | 246  | 232  | 218  | 204  |
| 39              | 190                | 176 | 162  | 148  | 134  | 121  | 107  | 093  | 079  | 065  |
| 40              | 051                | 037 | 023  | 009  | *996 | *982 | *968 | *954 | *940 | *926 |
| 41              | 9.93912            | 898 | 884  | 871  | 857  | 843  | 829  | 816  | 802  | 788  |
| 42              | 774                | 760 | 746  | 733  | 719  | 705  | 692  | 678  | 665  | 651  |
| 43              | 637                | 623 | 609  | 595  | 582  | 568  | 554  | 540  | 527  | 513  |
| 44              | 499                | 485 | 471  | 458  | 444  | 430  | 417  | 403  | 390  | 376  |
| 45              | 362                | 348 | 334  | 321  | 307  | 293  | 279  | 266  | 253  | 239  |
| 46              | 225                | 211 | 198  | 184  | 171  | 158  | 144  | 131  | 117  | 103  |
| 47              | 089                | 075 | 062  | 048  | 035  | 021  | 007  | *994 | *980 | *967 |
| 48              | 9.92953            | 940 | 926  | 913  | 899  | 885  | 871  | 858  | 844  | 831  |
| 49              | 818                | 804 | 791  | 777  | 764  | 750  | 737  | 723  | 710  | 696  |
| 50              | 683                | 670 | 656  | 643  | 629  | 616  | 603  | 589  | 576  | 562  |
| 51              | 549                | 536 | 522  | 509  | 496  | 482  | 469  | 455  | 442  | 428  |
| 52              | 415                | 402 | 388  | 375  | 361  | 348  | 335  | 321  | 308  | 294  |
| 53              | 281                | 268 | 254  | 240  | 227  | 214  | 200  | 187  | 173  | 160  |
| 54              | 147                | 134 | 120  | 107  | 094  | 080  | 067  | 054  | 040  | 027  |
| 55              | 014                | 001 | *988 | *974 | *961 | *948 | *935 | *921 | *908 | *895 |
| 56              | 9.91882            | 869 | 856  | 842  | 829  | 816  | 803  | 790  | 776  | 763  |
| 57              | 750                | 737 | 724  | 711  | 698  | 684  | 671  | 658  | 645  | 632  |
| 58              | 619                | 606 | 593  | 580  | 567  | 553  | 540  | 527  | 514  | 501  |
| 59              | 488                | 475 | 462  | 449  | 436  | 422  | 409  | 396  | 383  | 370  |
| 60              | 357                | 344 | 331  | 318  | 305  | 292  | 279  | 266  | 253  | 240  |
| 61              | 227                | 214 | 201  | 188  | 175  | 162  | 149  | 136  | 123  | 110  |
| 62              | 097                | 084 | 071  | 058  | 045  | 032  | 019  | 006  | *993 | *980 |
| 63              | 9.90967            | 954 | 941  | 928  | 915  | 902  | 889  | 876  | 863  | 851  |
| 64              | 838                | 825 | 812  | 799  | 786  | 773  | 760  | 747  | 735  | 722  |
| 65              | 709                | 696 | 683  | 670  | 657  | 644  | 632  | 619  | 606  | 593  |
| 66              | 580                | 567 | 554  | 542  | 529  | 516  | 503  | 490  | 478  | 465  |
| 67              | 452                | 439 | 426  | 414  | 401  | 388  | 375  | 363  | 350  | 337  |
| 68              | 324                | 311 | 298  | 286  | 273  | 260  | 248  | 235  | 223  | 210  |
| 69              | 197                | 184 | 172  | 159  | 146  | 134  | 121  | 108  | 096  | 083  |
| 70              | 070                | 057 | 044  | 032  | 019  | 006  | *993 | *980 | *968 | *956 |
| 71              | 9.89943            | 930 | 918  | 905  | 893  | 880  | 867  | 855  | 842  | 830  |
| 72              | 817                | 805 | 792  | 780  | 767  | 755  | 742  | 730  | 717  | 704  |
| 73              | 691                | 679 | 666  | 654  | 641  | 628  | 616  | 603  | 591  | 578  |
| 74              | 565                | 553 | 540  | 528  | 515  | 503  | 490  | 478  | 465  | 453  |

| t               | Tenths of Degrees. |      |      |      |      |      |      |      |      |      |
|-----------------|--------------------|------|------|------|------|------|------|------|------|------|
|                 | 0.0                | 0.1  | 0.2  | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 75 <sup>o</sup> | 9.89440            | 428  | 415  | 403  | 390  | 378  | 366  | 353  | 341  | 328  |
| 76              | 316                | 304  | 291  | 279  | 266  | 254  | 241  | 229  | 216  | 204  |
| 77              | 91                 | 179  | 166  | 154  | 141  | 129  | 117  | 104  | 092  | 079  |
| 78              | 067                | 054  | 042  | 029  | 017  | 005  | *992 | *980 | *967 | *955 |
| 79              | 9.88943            | 931  | 919  | 906  | 894  | 882  | 869  | 857  | 845  | 833  |
| 80              | 820                | 808  | 796  | 783  | 771  | 759  | 747  | 734  | 722  | 710  |
| 81              | 697                | 685  | 673  | 661  | 648  | 636  | 624  | 612  | 599  | 587  |
| 82              | 574                | 562  | 550  | 538  | 525  | 513  | 501  | 489  | 477  | 464  |
| 83              | 452                | 440  | 428  | 416  | 403  | 391  | 379  | 367  | 354  | 342  |
| 84              | 330                | 318  | 306  | 294  | 282  | 269  | 257  | 245  | 233  | 221  |
| 85              | 209                | 197  | 185  | 173  | 160  | 148  | 136  | 124  | 111  | 099  |
| 86              | 087                | 075  | 063  | 051  | 039  | 026  | 014  | 002  | *990 | *978 |
| 87              | 9.87966            | 954  | 942  | 930  | 918  | 905  | 893  | 881  | 869  | 857  |
| 88              | 845                | 833  | 821  | 809  | 797  | 785  | 773  | 761  | 749  | 737  |
| 89              | 725                | 713  | 701  | 689  | 677  | 665  | 653  | 641  | 629  | 617  |
| 90              | 605                | 593  | 581  | 569  | 557  | 545  | 533  | 521  | 509  | 497  |
| 91              | 485                | 473  | 461  | 449  | 437  | 426  | 414  | 402  | 390  | 378  |
| 92              | 366                | 354  | 342  | 330  | 318  | 306  | 295  | 283  | 271  | 259  |
| 93              | 247                | 235  | 223  | 212  | 200  | 188  | 176  | 165  | 153  | 141  |
| 94              | 129                | 117  | 105  | 093  | 081  | 070  | 058  | 046  | 034  | 022  |
| 95              | 010                | *998 | *986 | *975 | *963 | *951 | *939 | *928 | *916 | *904 |
| 96              | 9.86892            | 880  | 868  | 857  | 845  | 833  | 821  | 809  | 798  | 786  |
| 97              | 774                | 762  | 750  | 739  | 727  | 715  | 704  | 692  | 680  | 669  |
| 98              | 657                | 645  | 633  | 621  | 610  | 598  | 586  | 574  | 563  | 551  |
| 99              | 539                | 527  | 516  | 504  | 493  | 481  | 469  | 458  | 446  | 435  |
| 100             | 423                | 412  | 400  | 389  | 378  | 366  | 355  | 343  | 331  | 319  |
| 101             | 307                | 296  | 284  | 273  | 261  | 249  | 238  | 226  | 214  | 203  |
| 102             | 191                | 179  | 168  | 156  | 145  | 133  | 121  | 110  | 098  | 087  |
| 103             | 075                | 063  | 052  | 040  | 029  | 017  | 005  | *994 | *982 | *971 |
| 104             | 9.85959            | 948  | 936  | 925  | 913  | 902  | 890  | 879  | 867  | 856  |
| 105             | 844                | 833  | 821  | 810  | 798  | 787  | 775  | 764  | 752  | 741  |
| 106             | 729                | 718  | 706  | 695  | 683  | 672  | 661  | 649  | 638  | 626  |
| 107             | 615                | 603  | 592  | 580  | 569  | 557  | 546  | 534  | 523  | 511  |
| 108             | 500                | 488  | 477  | 465  | 454  | 443  | 431  | 420  | 408  | 397  |
| 109             | 386                | 374  | 363  | 351  | 340  | 329  | 317  | 306  | 295  | 283  |
| 110             | 272                | 261  | 249  | 238  | 227  | 215  | 204  | 193  | 181  | 170  |
| 111             | 159                | 148  | 136  | 125  | 114  | 102  | 091  | 080  | 069  | 057  |
| 112             | 046                | 035  | 023  | 012  | 001  | *989 | *978 | *967 | *955 | *944 |
| 113             | 9.84933            | 922  | 911  | 899  | 888  | 877  | 866  | 854  | 843  | 832  |
| 114             | 821                | 810  | 799  | 787  | 776  | 765  | 754  | 742  | 731  | 720  |



| t   | Tenths of Degrees. |      |     |     |      |      |      |      |      |      |
|-----|--------------------|------|-----|-----|------|------|------|------|------|------|
|     | 0.0                | 0.1  | 0.2 | 0.3 | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 115 | 9.84709            | 698. | 687 | 675 | 664  | 653  | 642  | 630  | 619  | 608  |
| 116 | 597                | 586  | 575 | 563 | 552  | 541  | 530  | 518  | 507  | 496  |
| 117 | 485                | 474  | 463 | 451 | 440  | 429  | 418  | 407  | 395  | 384  |
| 118 | 373                | 362  | 351 | 340 | 329  | 317  | 306  | 295  | 284  | 273  |
| 119 | 262                | 251  | 240 | 229 | 218  | 207  | 196  | 185  | 174  | 163  |
| 120 | 152                | 141  | 130 | 119 | 107  | 096  | 085  | 074  | 063  | 052  |
| 121 | 041                | 030  | 019 | 008 | *997 | *985 | *974 | *963 | *952 | *941 |
| 122 | 9.83931            | 920  | 909 | 898 | 887  | 876  | 865  | 854  | 843  | 832  |
| 123 | 821                | 810  | 799 | 788 | 777  | 766  | 756  | 745  | 734  | 723  |
| 124 | 712                | 701  | 690 | 679 | 668  | 657  | 646  | 635  | 624  | 613  |
| 125 | 602                | 591  | 580 | 569 | 558  | 547  | 536  | 525  | 514  | 503  |
| 126 | 493                | 482  | 471 | 460 | 449  | 438  | 428  | 417  | 406  | 395  |
| 127 | 384                | 373  | 362 | 351 | 340  | 329  | 319  | 308  | 297  | 286  |
| 128 | 275                | 264  | 253 | 243 | 232  | 221  | 210  | 200  | 189  | 178  |
| 129 | 167                | 156  | 145 | 135 | 124  | 113  | 102  | 091  | 081  | 070  |
| 130 | 059                | 048  | 037 | 027 | 016  | 005  | *994 | *984 | *973 | *962 |
| 131 | 9.82951            | 940  | 929 | 919 | 908  | 897  | 886  | 876  | 865  | 854  |
| 132 | 844                | 833  | 822 | 812 | 801  | 790  | 779  | 769  | 758  | 747  |
| 133 | 737                | 726  | 715 | 705 | 694  | 683  | 672  | 662  | 651  | 640  |
| 134 | 630                | 619  | 608 | 598 | 587  | 576  | 565  | 554  | 544  | 533  |
| 135 | 523                | 512  | 501 | 491 | 480  | 469  | 458  | 448  | 437  | 426  |
| 136 | 416                | 405  | 395 | 384 | 373  | 363  | 352  | 342  | 331  | 320  |
| 137 | 310                | 299  | 289 | 278 | 267  | 257  | 246  | 235  | 225  | 214  |
| 138 | 204                | 193  | 183 | 172 | 162  | 151  | 141  | 130  | 120  | 109  |
| 139 | 099                | 088  | 078 | 067 | 057  | 046  | 035  | 025  | 014  | 004  |
| 140 | 9.81993            | 983  | 972 | 961 | 951  | 940  | 929  | 919  | 908  | 898  |
| 141 | 888                | 877  | 867 | 856 | 846  | 835  | 825  | 814  | 804  | 793  |
| 142 | 783                | 772  | 762 | 751 | 741  | 730  | 720  | 709  | 699  | 688  |
| 143 | 678                | 667  | 657 | 646 | 636  | 626  | 615  | 605  | 594  | 584  |
| 144 | 574                | 564  | 553 | 543 | 533  | 522  | 512  | 501  | 491  | 480  |
| 145 | 470                | 460  | 449 | 439 | 428  | 418  | 408  | 397  | 387  | 376  |
| 146 | 366                | 356  | 345 | 335 | 324  | 314  | 303  | 293  | 283  | 272  |
| 147 | 262                | 252  | 241 | 231 | 220  | 210  | 200  | 189  | 179  | 168  |
| 148 | 158                | 148  | 138 | 127 | 117  | 107  | 096  | 086  | 075  | 065  |
| 149 | 055                | 045  | 035 | 025 | 014  | 004  | *994 | *984 | *973 | *963 |
| 150 | 9.80953            | 943  | 932 | 922 | 911  | 901  | 891  | 881  | 871  | 860  |
| 151 | 850                | 840  | 830 | 819 | 809  | 799  | 789  | 779  | 768  | 758  |
| 152 | 748                | 738  | 728 | 717 | 707  | 697  | 687  | 677  | 667  | 656  |
| 153 | 646                | 636  | 626 | 615 | 605  | 595  | 585  | 575  | 565  | 554  |
| 154 | 544                | 534  | 524 | 514 | 503  | 493  | 483  | 473  | 463  | 452  |

| t                | Tenths of Degrees. |     |     |      |      |      |      |      |      |      |
|------------------|--------------------|-----|-----|------|------|------|------|------|------|------|
|                  | 0.0                | 0.1 | 0.2 | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 155 <sup>o</sup> | 9.80442            | 432 | 422 | 412  | 402  | 391  | 381  | 471  | 361  | 351  |
| 156              | 340                | 330 | 320 | 310  | 300  | 289  | 279  | 269  | 259  | 249  |
| 157              | 239                | 229 | 219 | 209  | 199  | 189  | 178  | 168  | 158  | 148  |
| 158              | 138                | 128 | 118 | 108  | 098  | 088  | 078  | 067  | 057  | 047  |
| 159              | 037                | 027 | 017 | 007  | *997 | *987 | *977 | *967 | *957 | *947 |
| 160              | 9.79937            | 927 | 917 | 907  | 897  | 887  | 877  | 867  | 857  | 847  |
| 161              | 837                | 827 | 817 | 807  | 797  | 787  | 777  | 767  | 757  | 747  |
| 162              | 737                | 727 | 717 | 707  | 697  | 687  | 677  | 667  | 657  | 647  |
| 163              | 637                | 627 | 617 | 607  | 597  | 587  | 577  | 567  | 557  | 547  |
| 164              | 537                | 527 | 517 | 507  | 497  | 487  | 477  | 467  | 457  | 447  |
| 165              | 437                | 427 | 417 | 407  | 397  | 388  | 378  | 368  | 358  | 348  |
| 166              | 338                | 328 | 318 | 309  | 299  | 289  | 279  | 270  | 260  | 250  |
| 167              | 240                | 230 | 220 | 210  | 200  | 191  | 181  | 171  | 161  | 151  |
| 168              | 141                | 131 | 121 | 111  | 102  | 092  | 082  | 072  | 062  | 052  |
| 169              | 042                | 032 | 022 | 013  | 003  | *993 | *983 | *973 | *964 | *954 |
| 170              | 9.78944            | 934 | 925 | 915  | 905  | 895  | 885  | 876  | 866  | 856  |
| 171              | 846                | 836 | 827 | 817  | 807  | 797  | 787  | 777  | 768  | 758  |
| 172              | 748                | 738 | 729 | 719  | 709  | 699  | 689  | 680  | 670  | 660  |
| 173              | 650                | 640 | 631 | 621  | 611  | 602  | 592  | 582  | 572  | 563  |
| 174              | 553                | 543 | 533 | 524  | 514  | 504  | 494  | 485  | 475  | 466  |
| 175              | 456                | 446 | 437 | 427  | 417  | 408  | 398  | 389  | 379  | 370  |
| 176              | 360                | 350 | 341 | 331  | 321  | 312  | 302  | 292  | 283  | 273  |
| 177              | 263                | 253 | 244 | 234  | 224  | 215  | 205  | 195  | 185  | 176  |
| 178              | 166                | 156 | 147 | 137  | 128  | 118  | 108  | 099  | 089  | 080  |
| 179              | 070                | 060 | 051 | 041  | 031  | 022  | 012  | 002  | *993 | *983 |
| 180              | 9.77973            | 964 | 954 | 945  | 935  | 926  | 916  | 906  | 897  | 887  |
| 181              | 878                | 868 | 859 | 849  | 840  | 830  | 821  | 811  | 801  | 792  |
| 182              | 782                | 772 | 763 | 753  | 743  | 734  | 724  | 715  | 705  | 696  |
| 183              | 686                | 677 | 667 | 658  | 648  | 639  | 629  | 620  | 610  | 601  |
| 184              | 591                | 582 | 572 | 563  | 553  | 544  | 534  | 525  | 515  | 506  |
| 185              | 496                | 487 | 477 | 468  | 458  | 449  | 439  | 430  | 420  | 411  |
| 186              | 402                | 392 | 383 | 373  | 364  | 354  | 345  | 335  | 326  | 316  |
| 187              | 307                | 297 | 288 | 278  | 269  | 259  | 250  | 240  | 231  | 221  |
| 188              | 212                | 202 | 193 | 183  | 174  | 164  | 155  | 146  | 136  | 127  |
| 189              | 118                | 108 | 099 | 089  | 080  | 071  | 061  | 052  | 043  | 033  |
| 190              | 024                | 014 | 005 | *996 | *986 | *977 | *968 | *958 | *949 | *940 |
| 191              | 9.76931            | 921 | 912 | 903  | 893  | 884  | 875  | 865  | 856  | 847  |
| 192              | 837                | 828 | 818 | 809  | 799  | 790  | 781  | 771  | 762  | 753  |
| 193              | 743                | 734 | 725 | 715  | 706  | 697  | 687  | 678  | 669  | 659  |
| 194              | 650                | 640 | 631 | 622  | 612  | 603  | 594  | 585  | 575  | 566  |

| t   | Tenths of Degrees. |      |      |      |      |      |      |      |      |      |
|-----|--------------------|------|------|------|------|------|------|------|------|------|
|     | 0.0                | 0.1  | 0.2  | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 195 | 9.76557            | 547  | 538  | 529  | 519  | 510  | 501  | 492  | 482  | 473  |
| 196 | 464                | 455  | 445  | 436  | 427  | 417  | 408  | 399  | 390  | 380  |
| 197 | 371                | 362  | 352  | 343  | 334  | 325  | 316  | 306  | 297  | 288  |
| 198 | 279                | 270  | 260  | 251  | 242  | 233  | 224  | 215  | 205  | 196  |
| 199 | 187                | 178  | 169  | 159  | 150  | 141  | 132  | 123  | 113  | 104  |
| 200 | 095                | 086  | 077  | 067  | 058  | 049  | 040  | 031  | 021  | 012  |
| 201 | 003                | *994 | *985 | *975 | *966 | *957 | *948 | *939 | *930 | *920 |
| 202 | 9.75911            | 902  | 893  | 884  | 875  | 865  | 856  | 847  | 838  | 829  |
| 203 | 820                | 811  | 802  | 793  | 784  | 774  | 765  | 756  | 747  | 738  |
| 204 | 729                | 720  | 711  | 702  | 693  | 683  | 674  | 665  | 656  | 647  |
| 205 | 638                | 629  | 620  | 611  | 602  | 592  | 583  | 573  | 565  | 556  |
| 206 | 547                | 538  | 529  | 520  | 511  | 501  | 492  | 483  | 474  | 465  |
| 207 | 456                | 447  | 438  | 429  | 420  | 411  | 402  | 393  | 384  | 375  |
| 208 | 366                | 357  | 348  | 339  | 330  | 320  | 311  | 302  | 293  | 284  |
| 209 | 275                | 266  | 257  | 248  | 239  | 230  | 221  | 212  | 203  | 194  |
| 210 | 185                | 176  | 167  | 158  | 149  | 140  | 131  | 122  | 113  | 104  |
| 211 | 095                | 086  | 077  | 068  | 059  | 050  | 042  | 033  | 024  | 015  |
| 212 | 006                | *997 | *988 | *979 | *970 | *961 | *953 | *944 | *935 | *926 |
| 213 | 9.74917            | 908  | 899  | 890  | 881  | 872  | 863  | 854  | 845  | 836  |
| 214 | 827                | 818  | 809  | 800  | 791  | 782  | 774  | 765  | 756  | 747  |
| 215 | 738                | 729  | 720  | 711  | 702  | 693  | 685  | 676  | 667  | 658  |
| 216 | 649                | 640  | 631  | 622  | 613  | 604  | 596  | 587  | 578  | 569  |
| 217 | 560                | 551  | 542  | 533  | 524  | 515  | 507  | 498  | 489  | 480  |
| 218 | 471                | 462  | 453  | 444  | 435  | 426  | 418  | 409  | 400  | 391  |
| 219 | 382                | 373  | 364  | 356  | 347  | 338  | 329  | 320  | 312  | 303  |
| 220 | 294                | 285  | 276  | 268  | 259  | 250  | 241  | 232  | 224  | 215  |
| 221 | 206                | 197  | 188  | 180  | 171  | 162  | 153  | 145  | 136  | 127  |
| 222 | 118                | 109  | 100  | 092  | 083  | 074  | 066  | 057  | 048  | 040  |
| 223 | 031                | 022  | 013  | 005  | *996 | *987 | *978 | *969 | *961 | *952 |
| 224 | 9.73943            | 934  | 926  | 917  | 908  | 900  | 891  | 882  | 874  | 865  |
| 225 | 856                | 847  | 839  | 830  | 821  | 813  | 804  | 795  | 787  | 778  |
| 226 | 769                | 760  | 752  | 743  | 734  | 726  | 717  | 708  | 700  | 691  |
| 227 | 682                | 673  | 665  | 656  | 647  | 639  | 630  | 621  | 613  | 604  |
| 228 | 595                | 586  | 578  | 569  | 560  | 552  | 543  | 534  | 526  | 517  |
| 229 | 508                | 499  | 491  | 482  | 474  | 465  | 456  | 447  | 439  | 430  |
| 230 | 422                | 413  | 405  | 396  | 387  | 379  | 370  | 361  | 353  | 344  |
| 231 | 335                | 326  | 318  | 309  | 301  | 292  | 283  | 275  | 266  | 258  |
| 232 | 249                | 240  | 232  | 223  | 215  | 206  | 197  | 189  | 180  | 172  |
| 233 | 163                | 154  | 146  | 137  | 129  | 120  | 111  | 103  | 094  | 086  |
| 234 | 077                | 068  | 060  | 051  | 043  | 034  | 026  | 017  | 009  | 000  |

| t                | Tenths of Degrees. |     |      |      |      |      |      |      |      |      |
|------------------|--------------------|-----|------|------|------|------|------|------|------|------|
|                  | 0.0                | 0.1 | 0.2  | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 235 <sup>0</sup> | 9.72992            | 983 | 975  | 966  | 958  | 949  | 940  | 932  | 923  | 915  |
| 236              | 906                | 898 | 889  | 881  | 873  | 864  | 856  | 847  | 839  | 830  |
| 237              | 821                | 813 | 804  | 796  | 787  | 779  | 770  | 762  | 753  | 745  |
| 238              | 736                | 728 | 719  | 711  | 702  | 694  | 685  | 677  | 668  | 660  |
| 239              | 651                | 643 | 634  | 626  | 617  | 609  | 600  | 592  | 583  | 575  |
| 240              | 566                | 558 | 549  | 541  | 532  | 524  | 515  | 507  | 498  | 490  |
| 241              | 481                | 473 | 464  | 456  | 447  | 439  | 431  | 422  | 414  | 405  |
| 242              | 397                | 388 | 380  | 371  | 363  | 354  | 346  | 338  | 329  | 321  |
| 243              | 313                | 304 | 296  | 287  | 279  | 271  | 262  | 254  | 245  | 237  |
| 244              | 229                | 221 | 212  | 204  | 195  | 187  | 179  | 170  | 162  | 153  |
| 245              | 145                | 137 | 128  | 120  | 111  | 103  | 095  | 086  | 078  | 069  |
| 246              | 061                | 053 | 044  | 036  | 027  | 019  | 011  | 002  | *994 | *985 |
| 247              | 9.71977            | 969 | 960  | 952  | 943  | 935  | 927  | 918  | 910  | 901  |
| 248              | 893                | 885 | 876  | 868  | 858  | 851  | 843  | 834  | 826  | 818  |
| 249              | 810                | 802 | 793  | 785  | 777  | 768  | 760  | 752  | 743  | 735  |
| 250              | 726                | 718 | 709  | 701  | 693  | 684  | 676  | 668  | 659  | 651  |
| 251              | 643                | 635 | 626  | 618  | 610  | 601  | 593  | 585  | 576  | 568  |
| 252              | 560                | 552 | 544  | 535  | 527  | 519  | 511  | 503  | 494  | 486  |
| 253              | 478                | 470 | 461  | 453  | 445  | 437  | 428  | 420  | 412  | 403  |
| 254              | 395                | 387 | 379  | 370  | 362  | 354  | 346  | 338  | 329  | 321  |
| 255              | 313                | 305 | 297  | 288  | 280  | 272  | 264  | 255  | 247  | 239  |
| 256              | 231                | 223 | 215  | 206  | 198  | 190  | 182  | 174  | 165  | 157  |
| 257              | 149                | 141 | 133  | 124  | 116  | 108  | 100  | 092  | 083  | 075  |
| 258              | 067                | 059 | 051  | 042  | 034  | 026  | 018  | 010  | 001  | *993 |
| 259              | 9.70985            | 977 | 969  | 960  | 952  | 944  | 936  | 928  | 919  | 911  |
| 260              | 903                | 895 | 887  | 878  | 870  | 862  | 854  | 846  | 838  | 830  |
| 261              | 822                | 814 | 806  | 797  | 789  | 781  | 773  | 765  | 756  | 748  |
| 262              | 740                | 732 | 724  | 716  | 708  | 699  | 691  | 683  | 675  | 667  |
| 263              | 659                | 651 | 643  | 635  | 627  | 618  | 610  | 602  | 594  | 586  |
| 264              | 578                | 570 | 562  | 554  | 546  | 538  | 530  | 521  | 513  | 505  |
| 265              | 497                | 489 | 481  | 473  | 465  | 457  | 448  | 440  | 432  | 424  |
| 266              | 416                | 408 | 400  | 392  | 384  | 375  | 367  | 359  | 351  | 343  |
| 267              | 335                | 327 | 319  | 311  | 303  | 295  | 287  | 279  | 271  | 263  |
| 268              | 255                | 247 | 239  | 231  | 223  | 215  | 207  | 199  | 191  | 183  |
| 269              | 175                | 167 | 159  | 151  | 143  | 135  | 127  | 119  | 111  | 103  |
| 270              | 095                | 087 | 079  | 071  | 063  | 055  | 047  | 039  | 031  | 023  |
| 271              | 015                | 007 | *999 | *991 | *983 | *975 | *967 | *959 | *951 | *943 |
| 272              | 9.69935            | 927 | 919  | 911  | 903  | 895  | 888  | 880  | 872  | 864  |
| 273              | 856                | 848 | 840  | 832  | 824  | 816  | 808  | 800  | 792  | 784  |
| 274              | 776                | 768 | 760  | 752  | 744  | 736  | 728  | 720  | 712  | 704  |



| t                | Tenths of Degrees. |      |      |      |      |      |      |      |      |      |
|------------------|--------------------|------|------|------|------|------|------|------|------|------|
|                  | 0.0                | 0.1  | 0.2  | 0.3  | 0.4  | 0.5  | 0.6  | 0.7  | 0.8  | 0.9  |
| 275 <sup>o</sup> | 9.69696            | 688  | 680  | 672  | 664  | 656  | 648  | 640  | 632  | 625  |
| 276              | 617                | 609  | 601  | 593  | 585  | 577  | 570  | 562  | 554  | 546  |
| 277              | 538                | 530  | 522  | 514  | 506  | 499  | 491  | 483  | 475  | 467  |
| 278              | 459                | 451  | 443  | 436  | 428  | 420  | 412  | 404  | 397  | 389  |
| 279              | 381                | 373  | 365  | 357  | 349  | 341  | 334  | 326  | 318  | 310  |
| 280              | 302                | 294  | 286  | 279  | 271  | 263  | 255  | 248  | 240  | 232  |
| 281              | 224                | 216  | 208  | 200  | 192  | 185  | 177  | 169  | 161  | 153  |
| 282              | 145                | 137  | 129  | 122  | 114  | 106  | 098  | 090  | 083  | 075  |
| 283              | 067                | 059  | 051  | 043  | 035  | 027  | 020  | 012  | 004  | *996 |
| 284              | 3.68988            | 980  | 972  | 965  | 957  | 949  | 941  | 933  | 926  | 918  |
| 285              | 910                | 902  | 895  | 887  | 879  | 871  | 864  | 856  | 848  | 841  |
| 286              | 833                | 825  | 817  | 810  | 802  | 794  | 786  | 778  | 771  | 763  |
| 287              | 755                | 747  | 740  | 732  | 724  | 716  | 709  | 701  | 693  | 686  |
| 288              | 678                | 670  | 662  | 655  | 647  | 639  | 631  | 623  | 616  | 608  |
| 289              | 600                | 592  | 585  | 577  | 569  | 561  | 554  | 546  | 538  | 531  |
| 290              | 523                | 515  | 508  | 500  | 492  | 484  | 477  | 469  | 461  | 454  |
| 291              | 446                | 438  | 431  | 423  | 415  | 407  | 399  | 392  | 384  | 377  |
| 292              | 369                | 361  | 354  | 346  | 338  | 330  | 323  | 315  | 307  | 300  |
| 293              | 292                | 284  | 277  | 269  | 261  | 253  | 246  | 238  | 230  | 223  |
| 294              | 215                | 207  | 200  | 192  | 184  | 176  | 169  | 161  | 153  | 146  |
| 295              | 138                | 130  | 123  | 115  | 107  | 100  | 092  | 085  | 077  | 070  |
| 296              | 062                | 054  | 047  | 039  | 031  | 023  | 016  | 008  | 000  | *993 |
| 297              | 9.67985            | 977  | 970  | 962  | 954  | 947  | 939  | 932  | 924  | 917  |
| 298              | 909                | 901  | 894  | 886  | 878  | 871  | 863  | 856  | 848  | 840  |
| 299              | 833                | 825  | 818  | 810  | 803  | 795  | 787  | 780  | 773  | 765  |
| 300              | 757                | 749  | 742  | 734  | 627  | 719  | 711  | 704  | 696  | 689  |
| 301              | 681                | 673  | 666  | 658  | 651  | 643  | 636  | 628  | 621  | 613  |
| 302              | 606                | 598  | 591  | 583  | 576  | 568  | 561  | 553  | 546  | 538  |
| 303              | 531                | 523  | 516  | 508  | 501  | 493  | 485  | 478  | 470  | 463  |
| 304              | 455                | 448  | 440  | 433  | 425  | 418  | 410  | 403  | 395  | 388  |
| 305              | 380                | 373  | 365  | 358  | 350  | 343  | 335  | 328  | 320  | 313  |
| 306              | 305                | 298  | 290  | 283  | 275  | 268  | 260  | 253  | 245  | 238  |
| 307              | 230                | 223  | 215  | 208  | 200  | 193  | 185  | 178  | 170  | 163  |
| 308              | 155                | 148  | 140  | 133  | 125  | 118  | 110  | 103  | 095  | 088  |
| 309              | 080                | 073  | 065  | 058  | 050  | 043  | 035  | 028  | 020  | 013  |
| 310              | 005                | *998 | *990 | *983 | *975 | *968 | *961 | *953 | *946 | *938 |
| 311              | 9.66931            | 923  | 916  | 908  | 901  | 893  | 886  | 878  | 871  | 863  |
| 312              | 856                | 848  | 841  | 834  | 826  | 819  | 812  | 804  | 797  | 789  |
| 313              | 782                | 774  | 767  | 759  | 752  | 744  | 737  | 730  | 722  | 715  |
| 314              | 708                | 700  | 693  | 685  | 678  | 671  | 663  | 656  | 648  | 641  |

| t                | Tenths of Degrees. |     |     |     |     |     |      |      |      |      |
|------------------|--------------------|-----|-----|-----|-----|-----|------|------|------|------|
|                  | 0.0                | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6  | 0.7  | 0.8  | 0.9  |
| 315 <sup>o</sup> | 9.66634            | 626 | 619 | 612 | 604 | 597 | 589  | 582  | 574  | 567  |
| 316              | 560                | 552 | 545 | 537 | 530 | 523 | 515  | 508  | 500  | 493  |
| 317              | 486                | 478 | 471 | 464 | 456 | 449 | 441  | 434  | 427  | 420  |
| 318              | 413                | 405 | 398 | 391 | 383 | 376 | 369  | 361  | 354  | 347  |
| 319              | 339                | 332 | 324 | 317 | 310 | 302 | 295  | 288  | 280  | 273  |
| 320              | 266                | 259 | 251 | 244 | 237 | 229 | 222  | 215  | 207  | 200  |
| 321              | 193                | 186 | 178 | 171 | 164 | 156 | 149  | 142  | 134  | 127  |
| 322              | 120                | 113 | 105 | 098 | 091 | 083 | 076  | 069  | 061  | 054  |
| 323              | 047                | 040 | 032 | 025 | 018 | 010 | 003  | *996 | *988 | *981 |
| 324              | 9.65974            | 967 | 959 | 952 | 945 | 937 | 930  | 923  | 915  | 908  |
| 325              | 901                | 894 | 886 | 879 | 872 | 864 | 857  | 850  | 842  | 835  |
| 326              | 828                | 821 | 814 | 806 | 799 | 792 | 785  | 777  | 770  | 763  |
| 327              | 756                | 749 | 741 | 734 | 727 | 720 | 713  | 705  | 698  | 691  |
| 328              | 684                | 677 | 669 | 662 | 655 | 647 | 640  | 633  | 625  | 618  |
| 329              | 611                | 604 | 596 | 589 | 582 | 575 | 568  | 560  | 553  | 546  |
| 330              | 539                | 532 | 524 | 517 | 510 | 503 | 496  | 488  | 481  | 474  |
| 331              | 467                | 460 | 452 | 445 | 438 | 431 | 424  | 417  | 409  | 402  |
| 332              | 395                | 388 | 381 | 374 | 367 | 359 | 352  | 345  | 338  | 331  |
| 333              | 324                | 317 | 309 | 302 | 295 | 288 | 281  | 273  | 266  | 259  |
| 334              | 252                | 245 | 237 | 230 | 223 | 216 | 209  | 201  | 194  | 187  |
| 335              | 180                | 173 | 166 | 159 | 152 | 144 | 137  | 130  | 123  | 116  |
| 336              | 109                | 102 | 094 | 087 | 080 | 073 | 066  | 058  | 051  | 044  |
| 337              | 037                | 030 | 023 | 016 | 009 | 001 | *994 | *987 | *980 | *973 |
| 338              | 9.64966            | 959 | 952 | 945 | 938 | 930 | 923  | 916  | 909  | 902  |
| 339              | 895                | 888 | 881 | 874 | 867 | 859 | 852  | 845  | 838  | 831  |
| 340              | 824                | 817 | 810 | 803 | 796 | 788 | 781  | 774  | 767  | 760  |
| 341              | 753                | 746 | 739 | 732 | 725 | 718 | 710  | 703  | 696  | 689  |
| 342              | 682                | 675 | 668 | 661 | 654 | 647 | 640  | 633  | 626  | 619  |
| 343              | 612                | 605 | 598 | 591 | 584 | 577 | 570  | 563  | 556  | 549  |
| 344              | 542                | 535 | 528 | 521 | 514 | 507 | 500  | 493  | 486  | 479  |
| 345              | 471                | 464 | 457 | 450 | 443 | 436 | 429  | 422  | 415  | 408  |
| 346              | 401                | 394 | 387 | 380 | 373 | 366 | 359  | 352  | 345  | 338  |
| 347              | 331                | 324 | 317 | 310 | 303 | 296 | 289  | 282  | 275  | 268  |
| 348              | 261                | 254 | 247 | 240 | 233 | 225 | 218  | 211  | 204  | 197  |
| 349              | 190                | 183 | 176 | 169 | 162 | 155 | 148  | 141  | 134  | 127  |
| 350              | 120                | 113 | 106 | 099 | 092 | 085 | 078  | 071  | 064  | 057  |



## TABLE

OF THE ELASTIC FORCE OF THE VAPOR OF WATER FROM  
—32° TO +230°.

REGNAULT. — Mémoires de l'Académie de France, Tome XXI. p. 624.

| Tem-<br>pera-<br>ture. | Elastic<br>Force. | Difference<br>for 1°. | Tem-<br>pera-<br>ture. | Elastic<br>Force. | Difference<br>for 1°. | Tem-<br>pera-<br>ture. | Elastic<br>Force. | Difference<br>for 1°. |
|------------------------|-------------------|-----------------------|------------------------|-------------------|-----------------------|------------------------|-------------------|-----------------------|
| °                      | mm.               | mm.                   | °                      | mm.               | mm.                   | °                      | mm.               | mm.                   |
| —32                    | 0.320             | 0.032                 | 9                      | 8.574             | 0.591                 | 50                     | 91.982            | 4.679                 |
| 31                     | 0.352             | 0.034                 | 10                     | 9.165             | 0.627                 | 51                     | 96.661            | 4.882                 |
| 30                     | 0.386             | 0.038                 | 11                     | 9.792             | 0.665                 | 52                     | 101.543           | 5.093                 |
| 29                     | 0.424             | 0.040                 | 12                     | 10.457            | 0.705                 | 53                     | 106.636           | 5.309                 |
| 28                     | 0.464             | 0.044                 | 13                     | 11.162            | 0.746                 | 54                     | 111.945           | 5.533                 |
| 27                     | 0.508             | 0.047                 | 14                     | 11.908            | 0.791                 | 55                     | 117.478           | 5.766                 |
| 26                     | 0.555             | 0.050                 | 15                     | 12.699            | 0.837                 | 56                     | 123.244           | 6.007                 |
| 25                     | 0.605             | 0.055                 | 16                     | 13.536            | 0.885                 | 57                     | 129.251           | 6.254                 |
| 24                     | 0.660             | 0.059                 | 17                     | 14.421            | 0.936                 | 58                     | 135.505           | 6.510                 |
| 23                     | 0.719             | 0.064                 | 18                     | 15.357            | 0.989                 | 59                     | 142.015           | 6.776                 |
| 22                     | 0.783             | 0.070                 | 19                     | 16.346            | 1.045                 | 60                     | 148.791           | 7.048                 |
| 21                     | 0.853             | 0.074                 | 20                     | 17.391            | 1.104                 | 61                     | 155.839           | 7.331                 |
| 20                     | 0.927             | 0.081                 | 21                     | 18.495            | 1.164                 | 62                     | 163.170           | 7.621                 |
| 19                     | 1.008             | 0.087                 | 22                     | 19.659            | 1.229                 | 63                     | 170.791           | 7.923                 |
| 18                     | 1.095             | 0.094                 | 23                     | 20.888            | 1.296                 | 64                     | 178.714           | 8.231                 |
| 17                     | 1.189             | 0.101                 | 24                     | 22.184            | 1.366                 | 65                     | 186.945           | 8.551                 |
| 16                     | 1.290             | 0.110                 | 25                     | 23.550            | 1.438                 | 66                     | 195.496           | 8.880                 |
| 15                     | 1.400             | 0.118                 | 26                     | 24.988            | 1.517                 | 67                     | 204.376           | 9.220                 |
| 14                     | 1.518             | 0.128                 | 27                     | 26.505            | 1.596                 | 68                     | 213.596           | 9.569                 |
| 13                     | 1.646             | 0.137                 | 28                     | 28.101            | 1.681                 | 69                     | 223.165           | 9.928                 |
| 12                     | 1.783             | 0.150                 | 29                     | 29.782            | 1.766                 | 70                     | 233.093           | 10.300                |
| 11                     | 1.933             | 0.160                 | 30                     | 31.548            | 1.858                 | 71                     | 243.393           | 10.680                |
| 10                     | 2.093             | 0.174                 | 31                     | 33.406            | 1.953                 | 72                     | 254.073           | 11.074                |
| 9                      | 2.267             | 0.188                 | 32                     | 35.359            | 2.052                 | 73                     | 265.147           | 11.477                |
| 8                      | 2.455             | 0.203                 | 33                     | 37.411            | 2.154                 | 74                     | 276.624           | 11.893                |
| 7                      | 2.658             | 0.218                 | 34                     | 39.565            | 2.262                 | 75                     | 288.517           | 12.321                |
| 6                      | 2.876             | 0.237                 | 35                     | 41.827            | 2.374                 | 76                     | 300.838           | 12.762                |
| 5                      | 3.113             | 0.245                 | 36                     | 44.201            | 2.490                 | 77                     | 313.600           | 13.211                |
| 4                      | 3.368             | 0.276                 | 37                     | 46.691            | 2.611                 | 78                     | 326.811           | 13.677                |
| 3                      | 3.644             | 0.297                 | 38                     | 49.302            | 2.737                 | 79                     | 340.488           | 14.155                |
| 2                      | 3.941             | 0.322                 | 39                     | 52.039            | 2.867                 | 80                     | 354.643           | 14.644                |
| — 1                    | 4.263             | 0.337                 | 40                     | 54.906            | 3.004                 | 81                     | 369.287           | 15.148                |
| 0                      | 4.600             | 0.340                 | 41                     | 57.910            | 3.145                 | 82                     | 384.435           | 15.666                |
| + 1                    | 4.940             | 0.362                 | 42                     | 61.055            | 3.291                 | 83                     | 400.101           | 16.197                |
| 2                      | 5.302             | 0.385                 | 43                     | 64.346            | 3.444                 | 84                     | 416.298           | 16.743                |
| 3                      | 5.687             | 0.410                 | 44                     | 67.790            | 3.601                 | 85                     | 433.041           | 17.303                |
| 4                      | 6.097             | 0.437                 | 45                     | 71.391            | 3.767                 | 86                     | 450.344           | 17.877                |
| 5                      | 6.534             | 0.464                 | 46                     | 75.158            | 3.935                 | 87                     | 468.221           | 18.466                |
| 6                      | 6.998             | 0.494                 | 47                     | 79.093            | 4.111                 | 88                     | 486.687           | 19.072                |
| 7                      | 7.492             | 0.525                 | 48                     | 83.204            | 4.295                 | 89                     | 505.759           | 19.691                |
| 8                      | 8.017             | 0.557                 | 49                     | 87.499            | 4.483                 | 90                     | 525.450           | 20.328                |

| Tem-<br>pera-<br>ture. | Elastic<br>Force. | Difference<br>for 1°. | Tem-<br>pera-<br>ture. | Elastic<br>Force. | Difference<br>for 1°. | Tem-<br>pera-<br>ture. | Elastic<br>Force. | Difference<br>for 1°. |
|------------------------|-------------------|-----------------------|------------------------|-------------------|-----------------------|------------------------|-------------------|-----------------------|
| °                      | mm.               | mm.                   | °                      | mm.               | mm.                   | °                      | mm.               | mm.                   |
| 91                     | 545.778           | 20.979                | 138                    | 2567.000          | 77.440                | 185                    | 8453.23           | 191.12                |
| 92                     | 566.757           | 21.649                | 139                    | 2641.440          | 76.190                | 186                    | 8644.35           | 194.47                |
| 93                     | 588.406           | 22.334                | 140                    | 2717.630          | 77.940                | 187                    | 8838.82           | 197.86                |
| 94                     | 610.740           | 23.038                | 141                    | 2795.570          | 79.730                | 188                    | 9036.68           | 201.27                |
| 95                     | 633.778           | 23.757                | 142                    | 2875.300          | 81.560                | 189                    | 9237.95           | 204.75                |
| 96                     | 657.535           | 24.494                | 143                    | 2956.860          | 83.400                | 190                    | 9442.70           | 208.23                |
| 97                     | 682.029           | 25.251                | 144                    | 3040.260          | 85.290                | 191                    | 9650.93           | 211.78                |
| 98                     | 707.280           | 26.025                | 145                    | 3125.550          | 87.190                | 192                    | 9862.71           | 215.33                |
| 99                     | 733.305           | 26.695                | 146                    | 3212.740          | 89.130                | 193                    | 10078.04          | 218.97                |
| 100                    | 760.000           | 27.590                | 147                    | 3301.870          | 91.110                | 194                    | 10297.01          | 222.62                |
| 101                    | 787.590           | 28.420                | 148                    | 3392.980          | 93.110                | 195                    | 10519.63          | 226.32                |
| 102                    | 816.010           | 29.270                | 149                    | 3486.090          | 95.140                | 196                    | 10745.95          | 230.05                |
| 103                    | 845.280           | 30.130                | 150                    | 3581.230          | 97.200                | 197                    | 10975.00          | 233.82                |
| 104                    | 875.410           | 31.000                | 151                    | 3678.430          | 99.310                | 198                    | 11209.82          | 237.64                |
| 105                    | 906.410           | 31.900                | 152                    | 3777.740          | 101.440               | 199                    | 11447.46          | 241.50                |
| 106                    | 938.310           | 32.830                | 153                    | 3879.180          | 103.590               | 200                    | 11688.96          | 245.41                |
| 107                    | 971.140           | 33.770                | 154                    | 3982.770          | 105.790               | 201                    | 11934.37          | 249.32                |
| 108                    | 1004.910          | 34.740                | 155                    | 4088.560          | 108.030               | 202                    | 12183.69          | 253.31                |
| 109                    | 1039.650          | 35.720                | 156                    | 4196.590          | 110.290               | 203                    | 12437.00          | 257.30                |
| 110                    | 1075.370          | 36.720                | 157                    | 4306.880          | 112.570               | 204                    | 12694.30          | 261.36                |
| 111                    | 1112.090          | 37.740                | 158                    | 4419.450          | 114.910               | 205                    | 12955.66          | 265.46                |
| 112                    | 1149.830          | 38.780                | 159                    | 4534.860          | 117.260               | 206                    | 13221.12          | 269.63                |
| 113                    | 1188.610          | 39.860                | 160                    | 4651.620          | 119.660               | 207                    | 13490.75          | 273.78                |
| 114                    | 1228.470          | 40.940                | 161                    | 4771.280          | 122.080               | 208                    | 13764.53          | 277.99                |
| 115                    | 1269.410          | 42.060                | 162                    | 4893.360          | 124.550               | 209                    | 14042.52          | 282.28                |
| 116                    | 1311.470          | 43.190                | 163                    | 5017.910          | 127.060               | 210                    | 14324.80          | 286.52                |
| 117                    | 1354.660          | 44.340                | 164                    | 5144.970          | 129.570               | 211                    | 14611.32          | 290.90                |
| 118                    | 1399.020          | 45.530                | 165                    | 5274.540          | 132.150               | 212                    | 14902.22          | 295.26                |
| 119                    | 1444.550          | 46.730                | 166                    | 5406.690          | 134.740               | 213                    | 15197.48          | 299.69                |
| 120                    | 1491.280          | 47.970                | 167                    | 5541.430          | 137.390               | 214                    | 15497.17          | 304.16                |
| 121                    | 1539.250          | 49.220                | 168                    | 5678.820          | 140.080               | 215                    | 15801.33          | 308.61                |
| 122                    | 1588.470          | 50.490                | 169                    | 5818.900          | 142.760               | 216                    | 16109.94          | 313.21                |
| 123                    | 1638.960          | 51.800                | 170                    | 5961.660          | 145.530               | 217                    | 16423.15          | 317.75                |
| 124                    | 1690.760          | 53.120                | 171                    | 6107.190          | 148.290               | 218                    | 16740.90          | 322.39                |
| 125                    | 1743.880          | 54.470                | 172                    | 6255.480          | 151.120               | 219                    | 17063.29          | 327.07                |
| 126                    | 1798.350          | 55.850                | 173                    | 6406.600          | 153.950               | 220                    | 17390.36          | 331.77                |
| 127                    | 1854.200          | 57.270                | 174                    | 6560.550          | 156.850               | 221                    | 17722.13          | 336.55                |
| 128                    | 1911.460          | 58.680                | 175                    | 6717.430          | 159.790               | 222                    | 18058.64          | 341.30                |
| 129                    | 1970.150          | 60.130                | 176                    | 6877.220          | 162.750               | 223                    | 18399.94          | 346.13                |
| 130                    | 2030.280          | 61.660                | 177                    | 7039.970          | 165.750               | 224                    | 18746.07          | 350.97                |
| 131                    | 2091.940          | 63.090                | 178                    | 7205.720          | 168.800               | 225                    | 19097.04          | 355.88                |
| 132                    | 2155.030          | 64.660                | 179                    | 7374.520          | 171.870               | 226                    | 19452.92          | 360.84                |
| 133                    | 2219.690          | 66.230                | 180                    | 7546.390          | 174.980               | 227                    | 19813.76          | 365.85                |
| 134                    | 2285.920          | 67.810                | 181                    | 7721.370          | 178.150               | 228                    | 20179.61          | 370.87                |
| 135                    | 2353.730          | 69.430                | 182                    | 7899.520          | 181.320               | 229                    | 20550.48          | 375.92                |
| 136                    | 2423.160          | 71.070                | 183                    | 8080.840          | 184.560               | 230                    | 20926.40          |                       |
| 137                    | 2494.230          | 72.770                | 184                    | 8265.400          | 187.830               |                        |                   |                       |











## TABLE

OF THE TENSION OF THE VAPOR OF MERCURY FOR EACH  
10 DEGREES.

REGNAULT. — Mémoires de l'Académie de France, Tome XXVI. p. 520.

| Temperature<br>of the Air<br>Thermome-<br>ter. | Tension. | Temperature<br>of the Air<br>Thermome-<br>ter. | Tension. | Temperature<br>of the Air<br>Thermome-<br>ter. | Tension. |
|------------------------------------------------|----------|------------------------------------------------|----------|------------------------------------------------|----------|
| °                                              | mm.      | °                                              | mm.      | °                                              | mm.      |
| 0                                              | 0.0200   | 180                                            | 11.00    | 360                                            | 797.74   |
| 10                                             | 0.0268   | 190                                            | 14.84    | 370                                            | 954.65   |
| 20                                             | 0.0372   | 200                                            | 19.90    | 380                                            | 1139.65  |
| 30                                             | 0.0530   | 210                                            | 26.35    | 390                                            | 1346.71  |
| 40                                             | 0.0767   | 220                                            | 34.70    | 400                                            | 1587.96  |
| 50                                             | 0.1120   | 230                                            | 45.35    | 410                                            | 1863.73  |
| 60                                             | 0.1643   | 240                                            | 58.82    | 420                                            | 2177.53  |
| 70                                             | 0.2410   | 250                                            | 75.75    | 430                                            | 2533.01  |
| 80                                             | 0.3528   | 260                                            | 96.73    | 440                                            | 2933.99  |
| 90                                             | 0.5142   | 270                                            | 123.01   | 450                                            | 3384.35  |
| 100                                            | 0.7455   | 280                                            | 155.17   | 460                                            | 3888.14  |
| 110                                            | 1.0734   | 290                                            | 194.46   | 470                                            | 4449.45  |
| 120                                            | 1.5341   | 300                                            | 242.15   | 480                                            | 5072.43  |
| 130                                            | 2.1752   | 310                                            | 299.69   | 490                                            | 5761.32  |
| 140                                            | 3.0592   | 320                                            | 368.73   | 500                                            | 6520.25  |
| 150                                            | 4.2664   | 330                                            | 450.91   | 510                                            | 7253.44  |
| 160                                            | 5.9002   | 340                                            | 548.35   | 520                                            | 8264.96  |
| 170                                            | 8.0912   | 350                                            | 663.18   |                                                |          |

## TABLE

FOR DIRECT NITROGEN DETERMINATIONS GIVING  $\frac{0.0012562}{(1 + 0.00367 t) 760}$ .

JAMES T. BROWN. — Jour. Chem. Soc. N. S. Vol. III. p. 210.

| t  | $\frac{0.0012562}{(1 + 0.00367 t) 760}$ | Diff. | t  | $\frac{0.0012562}{(1 + 0.00367 t) 760}$ | Diff. |
|----|-----------------------------------------|-------|----|-----------------------------------------|-------|
| 0  | 0.00000165289                           |       | 16 | 0.00000156121                           | 544   |
| 1  | 0.00000164685                           | 604   | 17 | 0.00000155582                           | 539   |
| 2  | 0.00000164085                           | 600   | 18 | 0.00000155047                           | 535   |
| 3  | 0.00000163489                           | 596   | 19 | 0.00000154515                           | 532   |
| 4  | 0.00000162898                           | 591   | 20 | 0.00000153986                           | 529   |
| 5  | 0.00000162311                           | 587   | 21 | 0.00000153462                           | 524   |
| 6  | 0.00000161728                           | 583   | 22 | 0.00000152941                           | 521   |
| 7  | 0.00000161149                           | 579   | 23 | 0.00000152423                           | 518   |
| 8  | 0.00000160574                           | 575   | 24 | 0.00000151909                           | 514   |
| 9  | 0.00000160004                           | 570   | 25 | 0.00000151398                           | 511   |
| 10 | 0.00000159438                           | 566   | 26 | 0.00000150891                           | 507   |
| 11 | 0.00000158875                           | 563   | 27 | 0.00000150387                           | 504   |
| 12 | 0.00000158317                           | 558   | 28 | 0.00000149887                           | 500   |
| 13 | 0.00000157762                           | 555   | 29 | 0.00000149389                           | 498   |
| 14 | 0.00000157211                           | 551   | 30 | 0.00000148896                           | 493   |
| 15 | 0.00000156665                           | 546   |    |                                         |       |

*Formula for the use of the above table.*

$$W = \frac{0.0012562}{(1 + 0.00367 t) 760} \times V \times P.$$

$W$  = weight of gas in grammes.

$t$  = temperature of gas.

$V$  = volume in cc.

$P$  = pressure in mm.

## TABLE

OF  $\frac{0.0012932}{760 (1 + 0.00367 t)}$ .

JAMES T. BROWN. — Jour. Chem. Soc. N. S. IV. p. 74.

| t     | A             | Diff. | t     | A             | Diff. |
|-------|---------------|-------|-------|---------------|-------|
| —20.0 | 0.00000183636 | 363   | 2.5   | 0.00000171733 | 317   |
| 19.5  | 0.00000183273 | 361   | 2.0   | 0.00000171416 | 317   |
| 19.0  | 0.00000182912 | 360   | 1.5   | 0.00000171099 | 315   |
| 18.5  | 0.00000182552 | 359   | 1.0   | 0.00000170784 | 314   |
| 18.0  | 0.00000182193 | 357   | — 0.5 | 0.00000170470 | 313   |
| 17.5  | 0.00000181836 | 356   | 0.0   | 0.00000170157 | 311   |
| 17.0  | 0.00000181480 | 355   | + 0.5 | 0.00000169846 | 311   |
| 16.5  | 0.00000181125 | 353   | 1.0   | 0.00000169535 | 309   |
| 16.0  | 0.00000180772 | 351   | 1.5   | 0.00000169226 | 308   |
| 15.5  | 0.00000180421 | 351   | 2.0   | 0.00000168918 | 308   |
| 15.0  | 0.00000180070 | 349   | 2.5   | 0.00000168610 | 306   |
| 14.5  | 0.00000179721 | 347   | 3.0   | 0.00000168304 | 305   |
| 14.0  | 0.00000179374 | 347   | 3.5   | 0.00000167999 | 303   |
| 13.5  | 0.00000179027 | 345   | 4.0   | 0.00000167696 | 303   |
| 13.0  | 0.00000178682 | 343   | 4.5   | 0.00000167393 | 302   |
| 12.5  | 0.00000178339 | 343   | 5.0   | 0.00000167091 | 300   |
| 12.0  | 0.00000177996 | 341   | 5.5   | 0.00000166791 | 300   |
| 11.5  | 0.00000177655 | 339   | 6.0   | 0.00000166491 | 298   |
| 11.0  | 0.00000177316 | 339   | 6.5   | 0.00000166193 | 297   |
| 10.5  | 0.00000176977 | 337   | 7.0   | 0.00000165896 | 297   |
| 10.0  | 0.00000176640 | 336   | 7.5   | 0.00000165599 | 295   |
| 9.5   | 0.00000176304 | 334   | 8.0   | 0.00000165304 | 294   |
| 9.0   | 0.00000175970 | 334   | 8.5   | 0.00000165010 | 293   |
| 8.5   | 0.00000175636 | 332   | 9.0   | 0.00000164717 | 292   |
| 8.0   | 0.00000175304 | 330   | 9.5   | 0.00000164425 | 291   |
| 7.5   | 0.00000174974 | 330   | 10.0  | 0.00000164134 | 290   |
| 7.0   | 0.00000174644 | 328   | 10.5  | 0.00000163844 | 289   |
| 6.5   | 0.00000174316 | 327   | 11.0  | 0.00000163555 | 288   |
| 6.0   | 0.00000173989 | 326   | 11.5  | 0.00000163267 | 287   |
| 5.5   | 0.00000173663 | 325   | 12.0  | 0.00000162980 | 286   |
| 5.0   | 0.00000173338 | 323   | 12.5  | 0.00000162694 | 285   |
| 4.5   | 0.00000173015 | 322   | 13.0  | 0.00000162409 | 284   |
| 4.0   | 0.00000172693 | 321   | 13.5  | 0.00000162125 | 283   |
| 3.5   | 0.00000172372 | 320   | 14.0  | 0.00000161842 | 282   |
| 3.0   | 0.00000172052 | 319   | 14.5  | 0.00000161560 | 281   |

| t     | A             | Diff. | t     | A             | Diff. |
|-------|---------------|-------|-------|---------------|-------|
| +15.0 | 0.00000161279 | 280   | +39.0 | 0.00000148852 | 238   |
| 15.5  | 0.00000160999 | 279   | 39.5  | 0.00000148614 | 238   |
| 16.0  | 0.00000160720 | 278   | 40.0  | 0.00000148376 | 237   |
| 16.5  | 0.00000160442 | 277   | 40.5  | 0.00000148139 | 237   |
| 17.0  | 0.00000160165 | 276   | 41.0  | 0.00000147902 | 235   |
| 17.5  | 0.00000159889 | 276   | 41.5  | 0.00000147667 | 235   |
| 18.0  | 0.00000159613 | 274   | 42.0  | 0.00000147432 | 234   |
| 18.5  | 0.00000159339 | 273   | 42.5  | 0.00000147198 | 233   |
| 19.0  | 0.00000159066 | 273   | 43.0  | 0.00000146965 | 233   |
| 19.5  | 0.00000158793 | 271   | 43.5  | 0.00000146732 | 232   |
| 20.0  | 0.00000158522 | 271   | 44.0  | 0.00000146500 | 231   |
| 20.5  | 0.00000158251 | 269   | 44.5  | 0.00000146269 | 230   |
| 21.0  | 0.00000157982 | 269   | 45.0  | 0.00000146039 | 230   |
| 21.5  | 0.00000157713 | 268   | 45.5  | 0.00000145809 | 229   |
| 22.0  | 0.00000157445 | 267   | 46.0  | 0.00000145580 | 228   |
| 22.5  | 0.00000157178 | 266   | 46.5  | 0.00000145352 | 227   |
| 23.0  | 0.00000156912 | 265   | 47.0  | 0.00000145125 | 227   |
| 23.5  | 0.00000156647 | 264   | 47.5  | 0.00000144898 | 226   |
| 24.0  | 0.00000156383 | 263   | 48.0  | 0.00000144672 | 225   |
| 24.5  | 0.00000156120 | 263   | 48.5  | 0.00000144447 | 225   |
| 25.0  | 0.00000155857 | 261   | 49.0  | 0.00000144222 | 224   |
| 25.5  | 0.00000155596 | 261   | 49.5  | 0.00000143998 | 223   |
| 26.0  | 0.00000155335 | 260   | 50.0  | 0.00000143775 | 445   |
| 26.5  | 0.00000155075 | 258   | 51.0  | 0.00000143330 | 442   |
| 27.0  | 0.00000154817 | 258   | 52.0  | 0.00000142888 | 439   |
| 27.5  | 0.00000154559 | 258   | 53.0  | 0.00000142449 | 436   |
| 28.0  | 0.00000154301 | 256   | 54.0  | 0.00000142013 | 434   |
| 28.5  | 0.00000154045 | 255   | 55.0  | 0.00000141579 | 431   |
| 29.0  | 0.00000153790 | 255   | 56.0  | 0.00000141148 | 428   |
| 29.5  | 0.00000153535 | 254   | 57.0  | 0.00000140720 | 426   |
| 30.0  | 0.00000153281 | 253   | 58.0  | 0.00000140294 | 423   |
| 30.5  | 0.00000153028 | 252   | 59.0  | 0.00000139871 | 421   |
| 31.0  | 0.00000152776 | 251   | 60.0  | 0.00000139450 | 418   |
| 31.5  | 0.00000152525 | 251   | 61.0  | 0.00000139032 | 416   |
| 32.0  | 0.00000152274 | 249   | 62.0  | 0.00000138616 | 413   |
| 32.5  | 0.00000152025 | 249   | 63.0  | 0.00000138203 | 410   |
| 33.0  | 0.00000151776 | 248   | 64.0  | 0.00000137793 | 409   |
| 33.5  | 0.00000151528 | 247   | 65.0  | 0.00000137384 | 406   |
| 34.0  | 0.00000151281 | 247   | 66.0  | 0.00000136978 | 403   |
| 34.5  | 0.00000151034 | 245   | 67.0  | 0.00000136575 | 401   |
| 35.0  | 0.00000150789 | 245   | 68.0  | 0.00000136174 | 399   |
| 35.5  | 0.00000150544 | 244   | 69.0  | 0.00000135775 | 396   |
| 36.0  | 0.00000150300 | 243   | 70.0  | 0.00000135379 | 395   |
| 36.5  | 0.00000150057 | 243   | 71.0  | 0.00000134984 | 391   |
| 37.0  | 0.00000149814 | 242   | 72.0  | 0.00000134593 | 390   |
| 37.5  | 0.00000149572 | 240   | 73.0  | 0.00000134203 | 387   |
| 38.0  | 0.00000149332 | 241   | 74.0  | 0.00000133816 | 385   |
| 38.5  | 0.00000149091 | 239   | 75.0  | 0.00000133431 | 383   |

| t   | A             | Diff. | t    | A             | Diff. |
|-----|---------------|-------|------|---------------|-------|
| 0   |               |       | 0    |               |       |
| +76 | 0.00000133048 | 381   | +124 | 0.00000116940 | 294   |
| 77  | 0.00000132667 | 379   | 125  | 0.00000116646 | 293   |
| 78  | 0.00000132288 | 376   | 126  | 0.00000116353 | 291   |
| 79  | 0.00000131912 | 374   | 127  | 0.00000116062 | 290   |
| 80  | 0.00000131538 | 372   | 128  | 0.00000115772 | 288   |
| 81  | 0.00000131166 | 370   | 129  | 0.00000115484 | 287   |
| 82  | 0.00000130796 | 368   | 130  | 0.00000115197 | 286   |
| 83  | 0.00000130428 | 366   | 131  | 0.00000114911 | 284   |
| 84  | 0.00000130062 | 364   | 132  | 0.00000114627 | 283   |
| 85  | 0.00000129698 | 362   | 133  | 0.00000114344 | 281   |
| 86  | 0.00000129336 | 360   | 134  | 0.00000114063 | 280   |
| 87  | 0.00000128976 | 357   | 135  | 0.00000113783 | 278   |
| 88  | 0.00000128619 | 356   | 136  | 0.00000113505 | 278   |
| 89  | 0.00000128263 | 354   | 137  | 0.00000113227 | 275   |
| 90  | 0.00000127909 | 352   | 138  | 0.00000112952 | 275   |
| 91  | 0.00000127557 | 350   | 139  | 0.00000112677 | 273   |
| 92  | 0.00000127207 | 348   | 140  | 0.00000112404 | 272   |
| 93  | 0.00000126859 | 346   | 141  | 0.00000112132 | 270   |
| 94  | 0.00000126513 | 344   | 142  | 0.00000111862 | 270   |
| 95  | 0.00000126169 | 343   | 143  | 0.00000111592 | 268   |
| 96  | 0.00000125826 | 340   | 144  | 0.00000111324 | 266   |
| 97  | 0.00000125486 | 339   | 145  | 0.00000111058 | 266   |
| 98  | 0.00000125147 | 337   | 146  | 0.00000110792 | 264   |
| 99  | 0.00000124810 | 335   | 147  | 0.00000110528 | 263   |
| 100 | 0.00000124475 | 333   | 148  | 0.00000110265 | 261   |
| 101 | 0.00000124142 | 332   | 149  | 0.00000110004 | 261   |
| 102 | 0.00000123810 | 330   | 150  | 0.00000109743 | 259   |
| 103 | 0.00000123480 | 328   | 151  | 0.00000109484 | 258   |
| 104 | 0.00000123152 | 326   | 152  | 0.00000109226 | 256   |
| 105 | 0.00000122826 | 324   | 153  | 0.00000108970 | 256   |
| 106 | 0.00000122502 | 323   | 154  | 0.00000108714 | 254   |
| 107 | 0.00000122179 | 321   | 155  | 0.00000108460 | 253   |
| 108 | 0.00000121858 | 320   | 156  | 0.00000108207 | 252   |
| 109 | 0.00000121538 | 318   | 157  | 0.00000107955 | 251   |
| 110 | 0.00000121220 | 316   | 158  | 0.00000107704 | 250   |
| 111 | 0.00000120904 | 314   | 159  | 0.00000107454 | 248   |
| 112 | 0.00000120590 | 313   | 160  | 0.00000107206 | 247   |
| 113 | 0.00000120277 | 311   | 161  | 0.00000106959 | 247   |
| 114 | 0.00000119966 | 310   | 162  | 0.00000106712 | 245   |
| 115 | 0.00000119656 | 308   | 163  | 0.00000106467 | 244   |
| 116 | 0.00000119348 | 306   | 164  | 0.00000106223 | 242   |
| 117 | 0.00000119042 | 305   | 165  | 0.00000105981 | 242   |
| 118 | 0.00000118737 | 303   | 166  | 0.00000105739 | 240   |
| 119 | 0.00000118434 | 302   | 167  | 0.00000105499 | 240   |
| 120 | 0.00000118132 | 300   | 168  | 0.00000105259 | 239   |
| 121 | 0.00000117832 | 299   | 169  | 0.00000105020 | 237   |
| 122 | 0.00000117533 | 297   | 170  | 0.00000104783 | 236   |
| 123 | 0.00000117236 | 296   | 171  | 0.00000104547 | 236   |



| t                  | A             | Diff. | t                  | A             | Diff. |
|--------------------|---------------|-------|--------------------|---------------|-------|
| + <sup>o</sup> 172 | 0.00000104311 | 234   | + <sup>o</sup> 220 | 0.00000094145 | 191   |
| 173                | 0.00000104077 | 233   | 221                | 0.00000093954 | 190   |
| 174                | 0.00000103844 | 232   | 222                | 0.00000093764 | 190   |
| 175                | 0.00000103612 | 231   | 223                | 0.00000093574 | 188   |
| 176                | 0.00000103381 | 230   | 224                | 0.00000093386 | 188   |
| 177                | 0.00000103151 | 229   | 225                | 0.00000093198 | 187   |
| 178                | 0.00000102922 | 228   | 226                | 0.00000093011 | 186   |
| 179                | 0.00000102694 | 227   | 227                | 0.00000092825 | 185   |
| 180                | 0.00000102467 | 226   | 228                | 0.00000092640 | 185   |
| 181                | 0.00000102241 | 225   | 229                | 0.00000092455 | 184   |
| 182                | 0.00000102016 | 224   | 230                | 0.00000092271 | 183   |
| 183                | 0.00000101792 | 223   | 231                | 0.00000092088 | 183   |
| 184                | 0.00000101569 | 222   | 232                | 0.00000091905 | 182   |
| 185                | 0.00000101347 | 221   | 233                | 0.00000091723 | 181   |
| 186                | 0.00000101126 | 220   | 234                | 0.00000091542 | 180   |
| 187                | 0.00000100906 | 219   | 235                | 0.00000091362 | 180   |
| 188                | 0.00000100687 | 218   | 236                | 0.00000091182 | 179   |
| 189                | 0.00000100469 | 217   | 237                | 0.00000091003 | 178   |
| 190                | 0.00000100252 | 217   | 238                | 0.00000090825 | 178   |
| 191                | 0.00000100035 | 215   | 239                | 0.00000090647 | 177   |
| 192                | 0.00000099820 | 215   | 240                | 0.00000090470 | 176   |
| 193                | 0.00000099605 | 213   | 241                | 0.00000090294 | 175   |
| 194                | 0.00000099392 | 213   | 242                | 0.00000090119 | 175   |
| 195                | 0.00000099179 | 211   | 243                | 0.00000089944 | 174   |
| 196                | 0.00000098968 | 211   | 244                | 0.00000089770 | 174   |
| 197                | 0.00000098757 | 210   | 245                | 0.00000089596 | 173   |
| 198                | 0.00000098547 | 209   | 246                | 0.00000089423 | 172   |
| 199                | 0.00000098338 | 208   | 247                | 0.00000089251 | 171   |
| 200                | 0.00000098130 | 207   | 248                | 0.00000089080 | 171   |
| 201                | 0.00000097923 | 207   | 249                | 0.00000088909 | 170   |
| 202                | 0.00000097716 | 205   | 250                | 0.00000088739 | 170   |
| 203                | 0.00000097511 | 205   | 251                | 0.00000088569 | 169   |
| 204                | 0.00000097306 | 204   | 252                | 0.00000088400 | 168   |
| 205                | 0.00000097102 | 203   | 253                | 0.00000088232 | 167   |
| 206                | 0.00000096899 | 202   | 254                | 0.00000088065 | 167   |
| 207                | 0.00000096697 | 201   | 255                | 0.00000087898 | 167   |
| 208                | 0.00000096496 | 201   | 256                | 0.00000087731 | 165   |
| 209                | 0.00000096295 | 199   | 257                | 0.00000087566 | 165   |
| 210                | 0.00000096096 | 199   | 258                | 0.00000087401 | 165   |
| 211                | 0.00000095897 | 198   | 259                | 0.00000087236 | 164   |
| 212                | 0.00000095699 | 197   | 260                | 0.00000087072 | 163   |
| 213                | 0.00000095502 | 196   | 261                | 0.00000086909 | 162   |
| 214                | 0.00000095306 | 196   | 262                | 0.00000086747 | 162   |
| 215                | 0.00000095110 | 194   | 263                | 0.00000086585 | 162   |
| 216                | 0.00000094916 | 194   | 264                | 0.00000086423 | 161   |
| 217                | 0.00000094722 | 193   | 265                | 0.00000086262 | 160   |
| 218                | 0.00000094529 | 193   | 266                | 0.00000086102 | 159   |
| 219                | 0.00000094336 | 191   | 267                | 0.00000085943 | 159   |

| t    | A             | Diff. | t    | A             | Diff. |
|------|---------------|-------|------|---------------|-------|
| 0    |               |       | 0    |               |       |
| +268 | 0.00000085784 | 159   | +310 | 0.00000079598 | 136   |
| 269  | 0.00000085625 | 158   | 311  | 0.00000079462 | 136   |
| 270  | 0.00000085467 | 157   | 312  | 0.00000079326 | 136   |
| 271  | 0.00000085310 | 157   | 313  | 0.00000079190 | 135   |
| 272  | 0.00000085153 | 156   | 314  | 0.00000079055 | 134   |
| 273  | 0.00000084997 | 155   | 315  | 0.00000078921 | 134   |
| 274  | 0.00000084842 | 155   | 316  | 0.00000078787 | 134   |
| 275  | 0.00000084687 | 155   | 317  | 0.00000078653 | 133   |
| 276  | 0.00000084532 | 153   | 318  | 0.00000078520 | 133   |
| 277  | 0.00000084379 | 154   | 319  | 0.00000078387 | 132   |
| 278  | 0.00000084225 | 152   | 320  | 0.00000078255 | 132   |
| 279  | 0.00000084073 | 153   | 321  | 0.00000078123 | 132   |
| 280  | 0.00000083920 | 151   | 322  | 0.00000077991 | 131   |
| 281  | 0.00000083769 | 151   | 323  | 0.00000077860 | 130   |
| 282  | 0.00000083618 | 151   | 324  | 0.00000077730 | 130   |
| 283  | 0.00000083467 | 150   | 325  | 0.00000077600 | 130   |
| 284  | 0.00000083317 | 149   | 326  | 0.00000077470 | 129   |
| 285  | 0.00000083168 | 149   | 327  | 0.00000077341 | 129   |
| 286  | 0.00000083019 | 149   | 328  | 0.00000077212 | 128   |
| 287  | 0.00000082870 | 148   | 329  | 0.00000077084 | 128   |
| 288  | 0.00000082722 | 147   | 330  | 0.00000076956 | 128   |
| 289  | 0.00000082575 | 147   | 331  | 0.00000076828 | 127   |
| 290  | 0.00000082428 | 146   | 332  | 0.00000076701 | 127   |
| 291  | 0.00000082282 | 146   | 333  | 0.00000076574 | 126   |
| 292  | 0.00000082136 | 145   | 334  | 0.00000076448 | 126   |
| 293  | 0.00000081991 | 145   | 335  | 0.00000076322 | 125   |
| 294  | 0.00000081846 | 144   | 336  | 0.00000076197 | 125   |
| 295  | 0.00000081702 | 144   | 337  | 0.00000076072 | 125   |
| 296  | 0.00000081558 | 143   | 338  | 0.00000075947 | 124   |
| 297  | 0.00000081415 | 143   | 339  | 0.00000075823 | 124   |
| 298  | 0.00000081272 | 142   | 340  | 0.00000075699 | 123   |
| 299  | 0.00000081130 | 141   | 341  | 0.00000075576 | 123   |
| 300  | 0.00000080989 | 142   | 342  | 0.00000075453 | 123   |
| 301  | 0.00000080847 | 140   | 343  | 0.00000075330 | 122   |
| 302  | 0.00000080707 | 141   | 344  | 0.00000075208 | 122   |
| 303  | 0.00000080566 | 139   | 345  | 0.00000075086 | 121   |
| 304  | 0.00000080427 | 140   | 346  | 0.00000074965 | 121   |
| 305  | 0.00000080287 | 138   | 347  | 0.00000074844 | 121   |
| 306  | 0.00000080149 | 139   | 348  | 0.00000074723 | 120   |
| 307  | 0.00000080010 | 138   | 349  | 0.00000074603 | 120   |
| 308  | 0.00000079872 | 137   | 350  | 0.00000074483 | 120   |
| 309  | 0.00000079735 | 137   |      |               |       |

## TABLE

OF  $\frac{0.00367}{1 + 0.00367t}$ .

JAMES T. BROWN. — Jour. Chem. Soc. N. S. IV. p. 74.

| t     | $\frac{0.00367}{1 + 0.00367t}$ | Diff. | t    | $\frac{0.00367}{1 + 0.00367t}$ | Diff. |
|-------|--------------------------------|-------|------|--------------------------------|-------|
| —20.0 | 0.00396071                     | 783   | —2.5 | 0.00370398                     | 685   |
| 19.5  | 0.00395288                     | 779   | 2.0  | 0.00369713                     | 682   |
| 19.0  | 0.00394509                     | 777   | 1.5  | 0.00369031                     | 680   |
| 18.5  | 0.00393732                     | 774   | 1.0  | 0.00368351                     | 677   |
| 18.0  | 0.00392958                     | 770   | —0.5 | 0.00367674                     | 674   |
| 17.5  | 0.00392188                     | 768   | 0.0  | 0.00367000                     | 673   |
| 17.0  | 0.00391420                     | 764   | +    | 0.00366327                     | 669   |
| 16.5  | 0.00390656                     | 762   | 1.0  | 0.00365658                     | 668   |
| 16.0  | 0.00389894                     | 758   | 1.5  | 0.00364990                     | 665   |
| 15.5  | 0.00389136                     | 756   | 2.0  | 0.00364325                     | 662   |
| 15.0  | 0.00388380                     | 753   | 2.5  | 0.00363663                     | 660   |
| 14.5  | 0.00387627                     | 750   | 3.0  | 0.00363003                     | 658   |
| 14.0  | 0.00386877                     | 747   | 3.5  | 0.00362345                     | 655   |
| 13.5  | 0.00386130                     | 744   | 4.0  | 0.00361690                     | 653   |
| 13.0  | 0.00385386                     | 741   | 4.5  | 0.00361037                     | 651   |
| 12.5  | 0.00384645                     | 738   | 5.0  | 0.00360386                     | 648   |
| 12.0  | 0.00383907                     | 736   | 5.5  | 0.00359738                     | 646   |
| 11.5  | 0.00383171                     | 732   | 6.0  | 0.00359092                     | 643   |
| 11.0  | 0.00382439                     | 730   | 6.5  | 0.00358449                     | 642   |
| 10.5  | 0.00381709                     | 727   | 7.0  | 0.00357807                     | 639   |
| 10.0  | 0.00380982                     | 725   | 7.5  | 0.00357168                     | 636   |
| 9.5   | 0.00380257                     | 721   | 8.0  | 0.00356532                     | 635   |
| 9.0   | 0.00379536                     | 719   | 8.5  | 0.00355897                     | 632   |
| 8.5   | 0.00378817                     | 716   | 9.0  | 0.00355265                     | 630   |
| 8.0   | 0.00378101                     | 714   | 9.5  | 0.00354635                     | 628   |
| 7.5   | 0.00377387                     | 711   | 10.0 | 0.00354007                     | 625   |
| 7.0   | 0.00376676                     | 708   | 10.5 | 0.00353382                     | 623   |
| 6.5   | 0.00375968                     | 705   | 11.0 | 0.00352759                     | 621   |
| 6.0   | 0.00375263                     | 703   | 11.5 | 0.00352138                     | 619   |
| 5.5   | 0.00374560                     | 700   | 12.0 | 0.00351519                     | 617   |
| 5.0   | 0.00373860                     | 698   | 12.5 | 0.00350902                     | 615   |
| 4.5   | 0.00373162                     | 695   | 13.0 | 0.00350287                     | 612   |
| 4.0   | 0.00372467                     | 692   | 13.5 | 0.00349675                     | 610   |
| 3.5   | 0.00371775                     | 690   | 14.0 | 0.00349065                     | 609   |
| 3.0   | 0.00371085                     | 687   | 14.5 | 0.00348456                     | 606   |

| $t$   | $\frac{0.00367}{1 + 0.00367t}$ | Diff. | $t$   | $\frac{0.00367}{1 + 0.00367t}$ | Diff. |
|-------|--------------------------------|-------|-------|--------------------------------|-------|
| +15.0 | 0.00347850                     | 604   | +33.0 | 0.00327354                     | 535   |
| 15.5  | 0.00347246                     | 601   | 33.5  | 0.00326819                     | 533   |
| 16.0  | 0.00346645                     | 600   | 34.0  | 0.00326286                     | 532   |
| 16.5  | 0.00346045                     | 598   | 34.5  | 0.00325754                     | 530   |
| 17.0  | 0.00345447                     | 596   | 35.0  | 0.00325224                     | 528   |
| 17.5  | 0.00344851                     | 593   | 35.5  | 0.00324696                     | 526   |
| 18.0  | 0.00344258                     | 592   | 36.0  | 0.00324170                     | 524   |
| 18.5  | 0.00343666                     | 589   | 36.5  | 0.00323646                     | 523   |
| 19.0  | 0.00343077                     | 588   | 37.0  | 0.00323123                     | 522   |
| 19.5  | 0.00342489                     | 585   | 37.5  | 0.00322601                     | 519   |
| 20.0  | 0.00341904                     | 584   | 38.0  | 0.00322082                     | 518   |
| 20.5  | 0.00341320                     | 581   | 38.5  | 0.00321564                     | 516   |
| 21.0  | 0.00340739                     | 580   | 39.0  | 0.00321048                     | 515   |
| 21.5  | 0.00340159                     | 577   | 39.5  | 0.00320533                     | 513   |
| 22.0  | 0.00339582                     | 577   | 40.0  | 0.00320020                     | 511   |
| 22.5  | 0.00339005                     | 573   | 40.5  | 0.00319509                     | 509   |
| 23.0  | 0.00338432                     | 571   | 41.0  | 0.00319000                     | 508   |
| 23.5  | 0.00337861                     | 570   | 41.5  | 0.00318492                     | 507   |
| 24.0  | 0.00337291                     | 568   | 42.0  | 0.00317985                     | 505   |
| 24.5  | 0.00336723                     | 566   | 42.5  | 0.00317480                     | 503   |
| 25.0  | 0.00336157                     | 564   | 43.0  | 0.00316977                     | 501   |
| 25.5  | 0.00335593                     | 562   | 43.5  | 0.00316476                     | 500   |
| 26.0  | 0.00335031                     | 560   | 44.0  | 0.00315976                     | 499   |
| 26.5  | 0.00334471                     | 559   | 44.5  | 0.00315477                     | 497   |
| 27.0  | 0.00333912                     | 556   | 45.0  | 0.00314980                     | 495   |
| 27.5  | 0.00333356                     | 555   | 45.5  | 0.00314485                     | 494   |
| 28.0  | 0.00332801                     | 553   | 46.0  | 0.00313991                     | 492   |
| 28.5  | 0.00332248                     | 551   | 46.5  | 0.00313499                     | 490   |
| 29.0  | 0.00331697                     | 549   | 47.0  | 0.00313009                     | 490   |
| 29.5  | 0.00331148                     | 548   | 47.5  | 0.00312519                     | 487   |
| 30.0  | 0.00330600                     | 545   | 48.0  | 0.00312032                     | 486   |
| 30.5  | 0.00330055                     | 544   | 48.5  | 0.00311546                     | 485   |
| 31.0  | 0.00329511                     | 542   | 49.0  | 0.00311061                     | 483   |
| 31.5  | 0.00328969                     | 540   | 49.5  | 0.00310578                     | 481   |
| 32.0  | 0.00328429                     | 539   | 50.0  | 0.00310097                     |       |
| 32.5  | 0.00327890                     | 536   |       |                                |       |

## EXAMPLE

OF THE USE OF THE TABLES FOR REDUCTION OF A BAROMETER  
TO 0°.

|                                            |              |
|--------------------------------------------|--------------|
| Observed height Barometer with glass scale | mm.<br>740.0 |
| Attached Thermometer                       | 14.5         |

|                |     |                 |
|----------------|-----|-----------------|
| Correction for | 10  | mm.<br>1.266140 |
| “ “            | 4   | 0.506460        |
| “ “            | 0.5 | 0.063307        |
| Total,         |     | <u>1.835907</u> |

True height of Barometer  $740 - 1.84 = 738.16$ .

If the temperature is below 0° C. the correction becomes Additive.

The table for a brass scale is used in the same manner.



## TABLE

FOR THE REDUCTION OF A BAROMETER WITH A GLASS SCALE TO 0° C.

BUNSEN. — Gasometrischen Tafeln, p. 14.

| Millime-<br>tres. | Degrees.       |                |                |                |                |                |                |                |                |                |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                   | 1              | 2              | 3              | 4              | 5              | 6              | 7              | 8              | 9              | 10             |
| 5                 | mm.<br>0.00085 | mm.<br>0.00171 | mm.<br>0.00256 | mm.<br>0.00342 | mm.<br>0.00428 | mm.<br>0.00513 | mm.<br>0.00599 | mm.<br>0.00684 | mm.<br>0.00770 | mm.<br>0.00855 |
| 10                | 0.00171        | 0.00342        | 0.00513        | 0.00684        | 0.00856        | 0.01027        | 0.01198        | 0.01369        | 0.01540        | 0.01711        |
| 15                | 0.00256        | 0.00513        | 0.00769        | 0.01026        | 0.01284        | 0.01540        | 0.01797        | 0.02053        | 0.02310        | 0.02566        |
| 20                | 0.00342        | 0.00684        | 0.01027        | 0.01368        | 0.01712        | 0.02054        | 0.02396        | 0.02738        | 0.03080        | 0.03422        |
| 25                | 0.00427        | 0.00855        | 0.01283        | 0.01710        | 0.02139        | 0.02567        | 0.02995        | 0.03422        | 0.03850        | 0.04277        |
| 30                | 0.00513        | 0.01026        | 0.01540        | 0.02052        | 0.02567        | 0.03080        | 0.03593        | 0.04107        | 0.04620        | 0.05133        |
| 35                | 0.00598        | 0.01197        | 0.01797        | 0.02394        | 0.02995        | 0.03594        | 0.04192        | 0.04791        | 0.05390        | 0.05988        |
| 40                | 0.00684        | 0.01368        | 0.02053        | 0.02736        | 0.03423        | 0.04107        | 0.04791        | 0.05476        | 0.06160        | 0.06844        |
| 45                | 0.00769        | 0.01539        | 0.02310        | 0.03078        | 0.03850        | 0.04620        | 0.05390        | 0.06160        | 0.06930        | 0.07699        |
| 50                | 0.00855        | 0.01711        | 0.02567        | 0.03422        | 0.04278        | 0.05133        | 0.05989        | 0.06844        | 0.07700        | 0.08555        |
| 55                | 0.00940        | 0.01882        | 0.02824        | 0.03764        | 0.04706        | 0.05646        | 0.06588        | 0.07528        | 0.08470        | 0.09410        |
| 60                | 0.01026        | 0.02053        | 0.03080        | 0.04106        | 0.05134        | 0.06160        | 0.07187        | 0.08213        | 0.09240        | 0.10266        |
| 65                | 0.01111        | 0.02324        | 0.03337        | 0.04449        | 0.05562        | 0.06673        | 0.07786        | 0.08897        | 0.10010        | 0.11121        |
| 70                | 0.01197        | 0.02595        | 0.03593        | 0.04791        | 0.05990        | 0.07187        | 0.08385        | 0.09582        | 0.10780        | 0.11977        |
| 75                | 0.01282        | 0.02567        | 0.03850        | 0.05153        | 0.06417        | 0.07700        | 0.08983        | 0.10266        | 0.11550        | 0.12832        |
| 80                | 0.01368        | 0.02738        | 0.04106        | 0.05476        | 0.06845        | 0.08213        | 0.09582        | 0.10951        | 0.12320        | 0.13688        |
| 85                | 0.01453        | 0.02909        | 0.04363        | 0.05818        | 0.07273        | 0.08727        | 0.10181        | 0.11635        | 0.13090        | 0.14543        |
| 90                | 0.01539        | 0.03080        | 0.04619        | 0.06160        | 0.07701        | 0.09240        | 0.10780        | 0.12320        | 0.13860        | 0.15399        |
| 95                | 0.01625        | 0.03251        | 0.04876        | 0.06502        | 0.08129        | 0.09753        | 0.11378        | 0.13004        | 0.14630        | 0.16254        |
| 100               | 0.01711        | 0.03422        | 0.05133        | 0.06844        | 0.08555        | 0.10266        | 0.11977        | 0.13688        | 0.15399        | 0.17110        |

|     |         |         |         |         |         |         |         |         |         |         |
|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 105 | 0.01796 | 0.03593 | 0.05390 | 0.07186 | 0.09983 | 0.10779 | 0.12576 | 0.14372 | 0.16169 | 0.17965 |
| 110 | 0.01882 | 0.03761 | 0.05646 | 0.07528 | 0.09411 | 0.11293 | 0.13175 | 0.15057 | 0.16939 | 0.18821 |
| 115 | 0.01967 | 0.03935 | 0.05903 | 0.07871 | 0.09839 | 0.11806 | 0.13774 | 0.15741 | 0.17709 | 0.19676 |
| 120 | 0.02053 | 0.04106 | 0.06160 | 0.08213 | 0.10266 | 0.12320 | 0.14372 | 0.16426 | 0.18479 | 0.20532 |
| 125 | 0.02138 | 0.04278 | 0.06416 | 0.08555 | 0.10694 | 0.12833 | 0.14971 | 0.17110 | 0.19248 | 0.21387 |
| 130 | 0.02224 | 0.04449 | 0.06673 | 0.08898 | 0.11122 | 0.13346 | 0.15570 | 0.17795 | 0.20018 | 0.22243 |
| 135 | 0.02309 | 0.04620 | 0.06929 | 0.09240 | 0.11549 | 0.13860 | 0.16169 | 0.18479 | 0.20788 | 0.23098 |
| 140 | 0.02395 | 0.04791 | 0.07186 | 0.09582 | 0.11977 | 0.14374 | 0.16767 | 0.19164 | 0.21558 | 0.23954 |
| 145 | 0.02480 | 0.04962 | 0.07442 | 0.09924 | 0.12405 | 0.14887 | 0.17366 | 0.19848 | 0.22328 | 0.24809 |
| 150 | 0.02566 | 0.05133 | 0.07699 | 0.10266 | 0.12832 | 0.15399 | 0.17965 | 0.20532 | 0.23098 | 0.25665 |
| 155 | 0.02651 | 0.05304 | 0.07956 | 0.10608 | 0.13260 | 0.15912 | 0.18564 | 0.21216 | 0.23868 | 0.26520 |
| 160 | 0.02737 | 0.05475 | 0.08212 | 0.10950 | 0.13688 | 0.16426 | 0.19163 | 0.21901 | 0.24638 | 0.27376 |
| 165 | 0.02822 | 0.05646 | 0.08469 | 0.11293 | 0.14116 | 0.16939 | 0.19762 | 0.22585 | 0.25408 | 0.28231 |
| 170 | 0.02908 | 0.05817 | 0.08726 | 0.11635 | 0.14543 | 0.17453 | 0.20361 | 0.23270 | 0.26178 | 0.29087 |
| 175 | 0.02994 | 0.05989 | 0.08982 | 0.11977 | 0.14971 | 0.17966 | 0.20959 | 0.23954 | 0.26948 | 0.29942 |
| 180 | 0.03079 | 0.06160 | 0.09239 | 0.12320 | 0.15399 | 0.18479 | 0.21553 | 0.24639 | 0.27718 | 0.30798 |
| 185 | 0.03165 | 0.06331 | 0.09495 | 0.12662 | 0.15827 | 0.18993 | 0.22157 | 0.25323 | 0.28488 | 0.31653 |
| 190 | 0.03250 | 0.06502 | 0.09752 | 0.13004 | 0.16254 | 0.19506 | 0.22756 | 0.26008 | 0.29258 | 0.32509 |
| 195 | 0.03336 | 0.06673 | 0.10008 | 0.13346 | 0.16682 | 0.20019 | 0.23355 | 0.26692 | 0.30028 | 0.33364 |
| 200 | 0.03422 | 0.06844 | 0.10266 | 0.13688 | 0.17110 | 0.20532 | 0.23954 | 0.27376 | 0.30798 | 0.34220 |
| 205 | 0.03507 | 0.07015 | 0.10523 | 0.14030 | 0.17538 | 0.21045 | 0.24553 | 0.28060 | 0.31568 | 0.35075 |
| 210 | 0.03593 | 0.07186 | 0.10779 | 0.14372 | 0.17966 | 0.21559 | 0.25152 | 0.28745 | 0.32338 | 0.35931 |
| 215 | 0.03678 | 0.07357 | 0.11036 | 0.14715 | 0.18394 | 0.22072 | 0.25751 | 0.29429 | 0.33108 | 0.36786 |
| 220 | 0.03764 | 0.07528 | 0.11293 | 0.15057 | 0.18821 | 0.22586 | 0.26349 | 0.30114 | 0.33878 | 0.37642 |
| 225 | 0.03849 | 0.07700 | 0.11549 | 0.15399 | 0.19249 | 0.23099 | 0.26948 | 0.30798 | 0.34647 | 0.38497 |
| 230 | 0.03935 | 0.07871 | 0.11805 | 0.15742 | 0.19677 | 0.23612 | 0.27547 | 0.31483 | 0.35417 | 0.39353 |
| 235 | 0.04020 | 0.08042 | 0.12062 | 0.16084 | 0.20105 | 0.24126 | 0.28145 | 0.32167 | 0.36187 | 0.40208 |
| 240 | 0.04106 | 0.08213 | 0.12318 | 0.16426 | 0.20532 | 0.24639 | 0.28744 | 0.32852 | 0.36957 | 0.41064 |
| 245 | 0.04191 | 0.08384 | 0.12575 | 0.16768 | 0.20960 | 0.25152 | 0.29343 | 0.33536 | 0.37727 | 0.41919 |
| 250 | 0.04277 | 0.08555 | 0.12832 | 0.17110 | 0.21387 | 0.25665 | 0.29942 | 0.34220 | 0.38497 | 0.42775 |

| Millime-<br>tres. | Degrees. |         |         |         |         |         |         |         |         |         |
|-------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                   | 1        | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | 10      |
|                   | mm.      | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     |
| 255               | 0.04362  | 0.08726 | 0.13089 | 0.17452 | 0.21815 | 0.26178 | 0.30541 | 0.34904 | 0.39267 | 0.43630 |
| 260               | 0.04448  | 0.08897 | 0.13345 | 0.17794 | 0.22243 | 0.26692 | 0.31140 | 0.35589 | 0.40037 | 0.44486 |
| 265               | 0.04534  | 0.09068 | 0.13601 | 0.18137 | 0.22671 | 0.27205 | 0.31739 | 0.36273 | 0.40807 | 0.45341 |
| 270               | 0.04619  | 0.09239 | 0.13858 | 0.18479 | 0.23098 | 0.27719 | 0.32338 | 0.36958 | 0.41577 | 0.46197 |
| 275               | 0.04705  | 0.09411 | 0.14115 | 0.18821 | 0.23526 | 0.28232 | 0.32936 | 0.37642 | 0.42347 | 0.47052 |
| 280               | 0.04790  | 0.09582 | 0.14371 | 0.19164 | 0.23954 | 0.28745 | 0.33535 | 0.38327 | 0.43117 | 0.47908 |
| 285               | 0.04876  | 0.09753 | 0.14628 | 0.19506 | 0.24381 | 0.29259 | 0.34134 | 0.39011 | 0.43887 | 0.48763 |
| 290               | 0.04961  | 0.09924 | 0.14884 | 0.19848 | 0.24809 | 0.29772 | 0.34733 | 0.39696 | 0.44657 | 0.49619 |
| 295               | 0.05047  | 0.10095 | 0.15141 | 0.20190 | 0.25237 | 0.30285 | 0.35332 | 0.40380 | 0.45427 | 0.50474 |
| 300               | 0.05133  | 0.10266 | 0.15399 | 0.20532 | 0.25665 | 0.30798 | 0.35931 | 0.41064 | 0.46197 | 0.51330 |
| 305               | 0.05218  | 0.10437 | 0.15656 | 0.20874 | 0.26093 | 0.31311 | 0.36530 | 0.41748 | 0.46967 | 0.52185 |
| 310               | 0.05304  | 0.10608 | 0.15912 | 0.21216 | 0.26521 | 0.31825 | 0.37129 | 0.42433 | 0.47737 | 0.53041 |
| 315               | 0.05389  | 0.10779 | 0.16169 | 0.21559 | 0.26949 | 0.32338 | 0.37728 | 0.43117 | 0.48507 | 0.53896 |
| 320               | 0.05475  | 0.10951 | 0.16426 | 0.21901 | 0.27376 | 0.32852 | 0.38326 | 0.43802 | 0.49277 | 0.54752 |
| 325               | 0.05560  | 0.11122 | 0.16682 | 0.22243 | 0.27804 | 0.33365 | 0.38925 | 0.44486 | 0.50046 | 0.55607 |
| 330               | 0.05646  | 0.11293 | 0.16939 | 0.22586 | 0.28232 | 0.33878 | 0.39524 | 0.45171 | 0.50816 | 0.56463 |
| 335               | 0.05731  | 0.11464 | 0.17195 | 0.22928 | 0.28659 | 0.34392 | 0.40122 | 0.45855 | 0.51586 | 0.57318 |
| 340               | 0.05817  | 0.11635 | 0.17452 | 0.23270 | 0.29087 | 0.34905 | 0.40721 | 0.46540 | 0.52356 | 0.58174 |
| 345               | 0.05902  | 0.11806 | 0.17708 | 0.23612 | 0.29515 | 0.35418 | 0.41320 | 0.47224 | 0.53126 | 0.59029 |
| 350               | 0.05988  | 0.11977 | 0.17965 | 0.23954 | 0.29942 | 0.35931 | 0.41919 | 0.47908 | 0.53896 | 0.59885 |
| 355               | 0.06074  | 0.12148 | 0.18222 | 0.24296 | 0.30370 | 0.36444 | 0.42518 | 0.48592 | 0.54666 | 0.60740 |
| 360               | 0.06159  | 0.12319 | 0.18478 | 0.24638 | 0.30798 | 0.36958 | 0.43117 | 0.49277 | 0.55436 | 0.61596 |
| 365               | 0.06245  | 0.12490 | 0.18735 | 0.24981 | 0.31226 | 0.37471 | 0.43716 | 0.49961 | 0.56206 | 0.62451 |
| 370               | 0.06330  | 0.12662 | 0.18992 | 0.25323 | 0.31653 | 0.37985 | 0.44315 | 0.50646 | 0.56976 | 0.63307 |
| 375               | 0.06416  | 0.12833 | 0.19248 | 0.25665 | 0.32081 | 0.38498 | 0.44913 | 0.51330 | 0.57746 | 0.64162 |

|     |         |         |         |         |         |         |         |         |         |         |
|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 380 | 0.06501 | 0.13004 | 0.19505 | 0.26008 | 0.32509 | 0.39011 | 0.45512 | 0.52015 | 0.58516 | 0.65018 |
| 385 | 0.06587 | 0.13175 | 0.19761 | 0.26350 | 0.32937 | 0.39525 | 0.46111 | 0.52699 | 0.59286 | 0.65873 |
| 390 | 0.06672 | 0.13346 | 0.20018 | 0.26692 | 0.33364 | 0.40038 | 0.46710 | 0.53384 | 0.60056 | 0.66729 |
| 395 | 0.06758 | 0.13517 | 0.20274 | 0.27034 | 0.33792 | 0.40552 | 0.47309 | 0.54068 | 0.60826 | 0.67584 |
| 400 | 0.06844 | 0.13688 | 0.20532 | 0.27376 | 0.34220 | 0.41064 | 0.47908 | 0.54752 | 0.61596 | 0.68440 |
| 405 | 0.06929 | 0.13859 | 0.20789 | 0.27718 | 0.34648 | 0.41577 | 0.48507 | 0.55436 | 0.62366 | 0.69295 |
| 410 | 0.07015 | 0.14030 | 0.21045 | 0.28060 | 0.35076 | 0.42091 | 0.49106 | 0.56121 | 0.63136 | 0.70151 |
| 415 | 0.07100 | 0.14201 | 0.21302 | 0.28403 | 0.35504 | 0.42604 | 0.49705 | 0.56805 | 0.63906 | 0.71006 |
| 420 | 0.07186 | 0.14373 | 0.21559 | 0.28745 | 0.35931 | 0.43118 | 0.50303 | 0.57490 | 0.64676 | 0.71862 |
| 425 | 0.07271 | 0.14544 | 0.21815 | 0.29087 | 0.36359 | 0.43631 | 0.50902 | 0.58174 | 0.65445 | 0.72717 |
| 430 | 0.07357 | 0.14715 | 0.22072 | 0.29430 | 0.36787 | 0.44144 | 0.51501 | 0.58859 | 0.66215 | 0.73573 |
| 435 | 0.07442 | 0.14886 | 0.22328 | 0.29772 | 0.37215 | 0.44658 | 0.52039 | 0.59543 | 0.66985 | 0.74428 |
| 440 | 0.07528 | 0.15057 | 0.22585 | 0.30114 | 0.37642 | 0.45171 | 0.52698 | 0.60228 | 0.67755 | 0.75284 |
| 445 | 0.07613 | 0.15228 | 0.22341 | 0.30456 | 0.38070 | 0.45684 | 0.53297 | 0.60912 | 0.68525 | 0.76139 |
| 450 | 0.07699 | 0.15399 | 0.23098 | 0.30798 | 0.38497 | 0.46197 | 0.53896 | 0.61596 | 0.69295 | 0.76995 |
| 455 | 0.07785 | 0.15570 | 0.23355 | 0.31140 | 0.38925 | 0.46710 | 0.54495 | 0.62280 | 0.70065 | 0.77850 |
| 460 | 0.07870 | 0.15741 | 0.23612 | 0.31482 | 0.39353 | 0.47224 | 0.55094 | 0.62965 | 0.70835 | 0.78706 |
| 465 | 0.07956 | 0.15912 | 0.23868 | 0.31825 | 0.39781 | 0.47737 | 0.55693 | 0.63649 | 0.71605 | 0.79561 |
| 470 | 0.08041 | 0.16084 | 0.24125 | 0.32167 | 0.40208 | 0.48251 | 0.56292 | 0.64334 | 0.72375 | 0.80417 |
| 475 | 0.08127 | 0.16255 | 0.24382 | 0.32509 | 0.40636 | 0.48764 | 0.56890 | 0.65018 | 0.73145 | 0.81272 |
| 480 | 0.08212 | 0.16426 | 0.24638 | 0.32852 | 0.41064 | 0.49277 | 0.57489 | 0.65703 | 0.73915 | 0.82128 |
| 485 | 0.08298 | 0.16597 | 0.24895 | 0.33194 | 0.41491 | 0.49791 | 0.58088 | 0.66387 | 0.74685 | 0.82983 |
| 490 | 0.08383 | 0.16768 | 0.25151 | 0.33536 | 0.41919 | 0.50304 | 0.58687 | 0.67072 | 0.75455 | 0.83839 |
| 495 | 0.08469 | 0.16939 | 0.25408 | 0.33878 | 0.42347 | 0.50817 | 0.59286 | 0.67756 | 0.76225 | 0.84694 |
| 500 | 0.08555 | 0.17110 | 0.25665 | 0.34220 | 0.42775 | 0.51330 | 0.59885 | 0.68440 | 0.76995 | 0.85550 |
| 505 | 0.08640 | 0.17281 | 0.25922 | 0.34562 | 0.43203 | 0.51843 | 0.60484 | 0.69124 | 0.77765 | 0.86405 |
| 510 | 0.08726 | 0.17452 | 0.26178 | 0.34904 | 0.43631 | 0.52357 | 0.61083 | 0.69809 | 0.78535 | 0.87261 |
| 515 | 0.08811 | 0.17623 | 0.26435 | 0.35247 | 0.44059 | 0.52870 | 0.61682 | 0.70493 | 0.79305 | 0.88116 |
| 520 | 0.08897 | 0.17795 | 0.26692 | 0.35589 | 0.44486 | 0.53384 | 0.62280 | 0.71178 | 0.80075 | 0.88972 |
| 525 | 0.08982 | 0.17966 | 0.26948 | 0.35931 | 0.44914 | 0.53897 | 0.62879 | 0.71862 | 0.80844 | 0.89827 |



| Millime-<br>tres. | Degrees. |         |         |         |         |         |         |         |         |         |
|-------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                   | 1        | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | 10      |
|                   | mm.      | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     |
| 530               | 0.09068  | 0.18137 | 0.27205 | 0.36274 | 0.45342 | 0.54410 | 0.63478 | 0.72547 | 0.81614 | 0.90683 |
| 535               | 0.09153  | 0.18308 | 0.27461 | 0.36616 | 0.45769 | 0.54924 | 0.64076 | 0.73231 | 0.82384 | 0.91538 |
| 540               | 0.09239  | 0.18479 | 0.27718 | 0.36958 | 0.46197 | 0.55437 | 0.64675 | 0.73916 | 0.83154 | 0.92394 |
| 545               | 0.09324  | 0.18650 | 0.27974 | 0.37300 | 0.46625 | 0.55950 | 0.65274 | 0.74600 | 0.83924 | 0.93249 |
| 550               | 0.09410  | 0.18821 | 0.28231 | 0.37642 | 0.47052 | 0.56463 | 0.65873 | 0.75284 | 0.84694 | 0.94105 |
| 555               | 0.09496  | 0.18992 | 0.28488 | 0.37984 | 0.47480 | 0.56976 | 0.66472 | 0.75968 | 0.85464 | 0.94960 |
| 560               | 0.09581  | 0.19163 | 0.28745 | 0.38266 | 0.47908 | 0.57490 | 0.67071 | 0.76653 | 0.86234 | 0.95816 |
| 565               | 0.09667  | 0.19334 | 0.29001 | 0.38669 | 0.48336 | 0.58003 | 0.67670 | 0.77337 | 0.87004 | 0.96671 |
| 570               | 0.09752  | 0.19506 | 0.29258 | 0.39011 | 0.48763 | 0.58517 | 0.68269 | 0.78022 | 0.87774 | 0.97527 |
| 575               | 0.09838  | 0.19677 | 0.29514 | 0.39353 | 0.49191 | 0.59030 | 0.68867 | 0.78706 | 0.88544 | 0.98382 |
| 580               | 0.09923  | 0.19848 | 0.29771 | 0.39696 | 0.49619 | 0.59543 | 0.69466 | 0.79391 | 0.89314 | 0.99238 |
| 585               | 0.10009  | 0.20019 | 0.30027 | 0.40038 | 0.50047 | 0.60057 | 0.70065 | 0.80075 | 0.90084 | 1.00093 |
| 590               | 0.10094  | 0.20190 | 0.30284 | 0.40380 | 0.50474 | 0.60570 | 0.70664 | 0.80760 | 0.90854 | 1.00949 |
| 595               | 0.10180  | 0.20361 | 0.30540 | 0.40722 | 0.50902 | 0.61083 | 0.71263 | 0.81444 | 0.91624 | 1.01804 |
| 600               | 0.10266  | 0.20532 | 0.30798 | 0.41064 | 0.51330 | 0.61596 | 0.71862 | 0.82128 | 0.92394 | 1.02660 |
| 605               | 0.10351  | 0.20703 | 0.31055 | 0.41406 | 0.51758 | 0.62109 | 0.72461 | 0.82812 | 0.93164 | 1.03515 |
| 610               | 0.10437  | 0.20874 | 0.31311 | 0.41748 | 0.52186 | 0.62623 | 0.73060 | 0.83497 | 0.93934 | 1.04371 |
| 615               | 0.10522  | 0.21045 | 0.31568 | 0.42091 | 0.52614 | 0.63136 | 0.73659 | 0.84181 | 0.94704 | 1.05226 |
| 620               | 0.10608  | 0.21217 | 0.31825 | 0.42433 | 0.53041 | 0.63650 | 0.74257 | 0.84866 | 0.95474 | 1.06082 |
| 625               | 0.10693  | 0.21388 | 0.32081 | 0.42775 | 0.53469 | 0.64163 | 0.74856 | 0.85550 | 0.96243 | 1.06937 |
| 630               | 0.10779  | 0.21559 | 0.32337 | 0.43118 | 0.53897 | 0.64676 | 0.75455 | 0.86235 | 0.97013 | 1.07793 |
| 635               | 0.10864  | 0.21730 | 0.32594 | 0.43460 | 0.54324 | 0.65190 | 0.76053 | 0.86919 | 0.97783 | 1.08648 |
| 640               | 0.10950  | 0.21901 | 0.32850 | 0.43802 | 0.54752 | 0.65703 | 0.76652 | 0.87604 | 0.98553 | 1.09504 |
| 645               | 0.11035  | 0.22072 | 0.32107 | 0.44144 | 0.55180 | 0.66216 | 0.77251 | 0.88288 | 0.99323 | 1.10359 |
| 650               | 0.11121  | 0.22243 | 0.33364 | 0.44486 | 0.55607 | 0.66729 | 0.77850 | 0.88972 | 1.00093 | 1.11215 |



|     |         |         |         |         |         |         |         |         |         |         |
|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 655 | 0.11207 | 0.22414 | 0.33621 | 0.44828 | 0.56035 | 0.67242 | 0.78449 | 0.89656 | 1.00863 | 1.12070 |
| 660 | 0.11292 | 0.22585 | 0.33877 | 0.45170 | 0.56463 | 0.67756 | 0.79048 | 0.90341 | 1.01633 | 1.12926 |
| 665 | 0.11378 | 0.22756 | 0.34134 | 0.45513 | 0.56891 | 0.68269 | 0.79647 | 0.91025 | 1.02403 | 1.13781 |
| 670 | 0.11463 | 0.22928 | 0.34391 | 0.45855 | 0.57318 | 0.68783 | 0.80246 | 0.91710 | 1.03173 | 1.14637 |
| 675 | 0.11549 | 0.23099 | 0.34647 | 0.46197 | 0.57746 | 0.69296 | 0.80844 | 0.92394 | 1.03943 | 1.15492 |
| 680 | 0.11634 | 0.23270 | 0.34904 | 0.46540 | 0.58174 | 0.69809 | 0.81443 | 0.93079 | 1.04713 | 1.16348 |
| 685 | 0.11720 | 0.23441 | 0.35160 | 0.46882 | 0.58602 | 0.70323 | 0.82042 | 0.93763 | 1.05483 | 1.17203 |
| 690 | 0.11805 | 0.23612 | 0.35417 | 0.47224 | 0.59029 | 0.70836 | 0.82641 | 0.94448 | 1.06253 | 1.18059 |
| 695 | 0.11891 | 0.23783 | 0.35673 | 0.47566 | 0.59457 | 0.71349 | 0.83240 | 0.95132 | 1.07023 | 1.18914 |
| 700 | 0.11977 | 0.23954 | 0.35931 | 0.47908 | 0.59885 | 0.71862 | 0.83839 | 0.95816 | 1.07793 | 1.19770 |
| 705 | 0.12062 | 0.24125 | 0.36188 | 0.48250 | 0.60313 | 0.72375 | 0.84438 | 0.96500 | 1.08563 | 1.20625 |
| 710 | 0.12148 | 0.24296 | 0.36444 | 0.48592 | 0.60741 | 0.72889 | 0.85037 | 0.97185 | 1.09333 | 1.21481 |
| 715 | 0.12233 | 0.24467 | 0.36701 | 0.48935 | 0.61169 | 0.73402 | 0.85636 | 0.97869 | 1.10103 | 1.22336 |
| 720 | 0.12319 | 0.24639 | 0.36958 | 0.49277 | 0.61596 | 0.73916 | 0.86234 | 0.98554 | 1.10873 | 1.23192 |
| 725 | 0.12404 | 0.24810 | 0.37214 | 0.49619 | 0.62024 | 0.74429 | 0.86833 | 0.99238 | 1.11642 | 1.24047 |
| 730 | 0.12490 | 0.24981 | 0.37471 | 0.49962 | 0.62452 | 0.74942 | 0.87432 | 0.99923 | 1.12412 | 1.24903 |
| 735 | 0.12575 | 0.25152 | 0.37727 | 0.50304 | 0.62880 | 0.75456 | 0.88030 | 1.00607 | 1.13182 | 1.25758 |
| 740 | 0.12661 | 0.25323 | 0.37984 | 0.50646 | 0.63307 | 0.75969 | 0.88629 | 1.01292 | 1.13952 | 1.26614 |
| 745 | 0.12746 | 0.25494 | 0.38240 | 0.50988 | 0.63735 | 0.76482 | 0.89228 | 1.01976 | 1.14722 | 1.27469 |
| 750 | 0.12832 | 0.25665 | 0.38497 | 0.51330 | 0.64162 | 0.76995 | 0.89827 | 1.02660 | 1.15492 | 1.28325 |
| 755 | 0.12918 | 0.25836 | 0.38754 | 0.51672 | 0.64590 | 0.77508 | 0.90426 | 1.03344 | 1.16262 | 1.29180 |
| 760 | 0.13003 | 0.26007 | 0.39011 | 0.52014 | 0.65018 | 0.78022 | 0.91025 | 1.04029 | 1.17032 | 1.30036 |
| 765 | 0.13089 | 0.26178 | 0.39267 | 0.52357 | 0.65446 | 0.78535 | 0.91624 | 1.04713 | 1.17802 | 1.30891 |
| 770 | 0.13174 | 0.26350 | 0.39524 | 0.52699 | 0.65873 | 0.79049 | 0.92223 | 1.05398 | 1.18572 | 1.31747 |
| 775 | 0.13260 | 0.26521 | 0.39781 | 0.53041 | 0.66301 | 0.79562 | 0.92821 | 1.06082 | 1.19342 | 1.32602 |
| 780 | 0.13345 | 0.26692 | 0.40037 | 0.53383 | 0.66729 | 0.80075 | 0.93420 | 1.06767 | 1.20112 | 1.33458 |
| 785 | 0.13431 | 0.26863 | 0.40294 | 0.53725 | 0.67157 | 0.80589 | 0.94019 | 1.07451 | 1.20882 | 1.34313 |
| 790 | 0.13516 | 0.27034 | 0.40550 | 0.54067 | 0.67584 | 0.81102 | 0.94618 | 1.08136 | 1.21652 | 1.35169 |
| 795 | 0.13602 | 0.27205 | 0.40707 | 0.54409 | 0.68012 | 0.81615 | 0.95217 | 1.08820 | 1.22422 | 1.36024 |
| 800 | 0.13688 | 0.27376 | 0.41064 | 0.54752 | 0.68440 | 0.82128 | 0.95816 | 1.09504 | 1.23192 | 1.36880 |

| Millime-<br>tres. | Degrees. |         |         |         |         |         |         |         |         |         |
|-------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                   | 1        | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | 10      |
|                   | mm.      | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     | mm.     |
| 805               | 0.13773  | 0.27547 | 0.41321 | 0.55094 | 0.68868 | 0.82641 | 0.96415 | 1.10118 | 1.23962 | 1.37735 |
| 810               | 0.13859  | 0.27718 | 0.41577 | 0.55436 | 0.69296 | 0.83155 | 0.97014 | 1.10873 | 1.24732 | 1.38591 |
| 815               | 0.13944  | 0.27889 | 0.41834 | 0.55779 | 0.69724 | 0.83668 | 0.97613 | 1.11557 | 1.25502 | 1.39446 |
| 820               | 0.14030  | 0.28061 | 0.42091 | 0.56121 | 0.70151 | 0.84182 | 0.98211 | 1.12242 | 1.26272 | 1.40302 |
| 825               | 0.14115  | 0.28232 | 0.42347 | 0.56463 | 0.70579 | 0.84695 | 0.98810 | 1.12926 | 1.27041 | 1.41157 |
| 830               | 0.14201  | 0.28403 | 0.42604 | 0.56806 | 0.71007 | 0.85208 | 0.99409 | 1.13611 | 1.27811 | 1.42013 |
| 835               | 0.14286  | 0.28574 | 0.42860 | 0.57148 | 0.71435 | 0.85722 | 1.00007 | 1.14295 | 1.28581 | 1.42868 |
| 840               | 0.14372  | 0.28745 | 0.43117 | 0.57490 | 0.71862 | 0.86235 | 1.00606 | 1.14980 | 1.29351 | 1.43724 |
| 845               | 0.14457  | 0.28916 | 0.43373 | 0.57832 | 0.72290 | 0.86748 | 1.01205 | 1.15664 | 1.30121 | 1.44579 |
| 850               | 0.14543  | 0.29087 | 0.43630 | 0.58174 | 0.72717 | 0.87261 | 1.01804 | 1.16348 | 1.30891 | 1.45435 |
| 855               | 0.14629  | 0.29258 | 0.43887 | 0.58516 | 0.73145 | 0.87774 | 1.02403 | 1.17032 | 1.31661 | 1.46290 |
| 860               | 0.14714  | 0.29429 | 0.44144 | 0.58858 | 0.73573 | 0.88288 | 1.03002 | 1.17717 | 1.32431 | 1.47146 |
| 865               | 0.14800  | 0.29600 | 0.44400 | 0.59201 | 0.74001 | 0.88801 | 1.03601 | 1.18401 | 1.33201 | 1.48001 |
| 870               | 0.14885  | 0.29772 | 0.44657 | 0.59543 | 0.74428 | 0.89315 | 1.04200 | 1.19086 | 1.33971 | 1.48857 |
| 875               | 0.14971  | 0.29943 | 0.44914 | 0.59885 | 0.74856 | 0.89828 | 1.04798 | 1.19770 | 1.34741 | 1.49712 |
| 880               | 0.15056  | 0.30114 | 0.45170 | 0.60228 | 0.75284 | 0.90341 | 1.05397 | 1.20455 | 1.35511 | 1.50568 |
| 885               | 0.15142  | 0.30285 | 0.45427 | 0.60570 | 0.75712 | 0.90855 | 1.05996 | 1.21139 | 1.36281 | 1.51423 |
| 890               | 0.15227  | 0.30456 | 0.45683 | 0.60912 | 0.76139 | 0.91368 | 1.06595 | 1.21824 | 1.37051 | 1.52279 |
| 895               | 0.15313  | 0.30627 | 0.45940 | 0.61354 | 0.76567 | 0.91881 | 1.07194 | 1.22508 | 1.37821 | 1.53134 |
| 900               | 0.15399  | 0.30798 | 0.46197 | 0.61596 | 0.76995 | 0.92394 | 1.07793 | 1.23192 | 1.38591 | 1.53990 |
| 905               | 0.15484  | 0.30969 | 0.46454 | 0.61938 | 0.77423 | 0.92907 | 1.08392 | 1.23876 | 1.39361 | 1.54845 |
| 910               | 0.15570  | 0.31140 | 0.46710 | 0.62280 | 0.77851 | 0.93421 | 1.08991 | 1.24561 | 1.40131 | 1.55701 |
| 915               | 0.15655  | 0.31311 | 0.46967 | 0.62623 | 0.78279 | 0.93934 | 1.09490 | 1.25245 | 1.40901 | 1.56556 |
| 920               | 0.15741  | 0.31483 | 0.47224 | 0.62965 | 0.78706 | 0.94448 | 1.10188 | 1.25930 | 1.41671 | 1.57412 |
| 925               | 0.15826  | 0.31654 | 0.47480 | 0.63307 | 0.79134 | 0.94961 | 1.10787 | 1.26614 | 1.42440 | 1.58267 |

|      |         |         |         |         |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 930  | 0.15912 | 0.31825 | 0.47737 | 0.63650 | 0.79562 | 0.95474 | 1.11386 | 1.27299 | 1.43210 | 1.59123 |
| 935  | 0.15997 | 0.31996 | 0.47993 | 0.63992 | 0.79989 | 0.95988 | 1.11984 | 1.27983 | 1.43980 | 1.59978 |
| 940  | 0.16083 | 0.32167 | 0.48250 | 0.64334 | 0.80417 | 0.96501 | 1.12583 | 1.28668 | 1.44750 | 1.60834 |
| 945  | 0.16168 | 0.32338 | 0.48506 | 0.64676 | 0.80845 | 0.97014 | 1.13182 | 1.29352 | 1.45520 | 1.61689 |
| 950  | 0.16254 | 0.32509 | 0.48763 | 0.65018 | 0.81273 | 0.97527 | 1.13781 | 1.30036 | 1.46290 | 1.62545 |
| 955  | 0.16339 | 0.32680 | 0.49020 | 0.65360 | 0.81701 | 0.98040 | 1.14380 | 1.30720 | 1.47060 | 1.63400 |
| 960  | 0.16425 | 0.32851 | 0.49277 | 0.65708 | 0.82129 | 0.98554 | 1.14979 | 1.31405 | 1.47830 | 1.64256 |
| 965  | 0.16510 | 0.33022 | 0.49533 | 0.66045 | 0.82557 | 0.99067 | 1.15578 | 1.32089 | 1.48600 | 1.65111 |
| 970  | 0.16596 | 0.33193 | 0.49790 | 0.66387 | 0.82984 | 0.99581 | 1.16177 | 1.32774 | 1.49370 | 1.65967 |
| 975  | 0.16681 | 0.33364 | 0.50047 | 0.66729 | 0.83412 | 1.00094 | 1.16775 | 1.33458 | 1.50140 | 1.66822 |
| 980  | 0.16767 | 0.33535 | 0.50303 | 0.67072 | 0.83840 | 1.00607 | 1.17374 | 1.34143 | 1.50910 | 1.67678 |
| 985  | 0.16852 | 0.33706 | 0.50560 | 0.67414 | 0.84268 | 1.01121 | 1.17973 | 1.34827 | 1.51680 | 1.68533 |
| 990  | 0.16938 | 0.33877 | 0.50816 | 0.67756 | 0.84695 | 1.01634 | 1.18572 | 1.35512 | 1.52450 | 1.69389 |
| 995  | 0.17023 | 0.34048 | 0.51073 | 0.68098 | 0.85123 | 1.02147 | 1.19171 | 1.36196 | 1.53220 | 1.70244 |
| 1000 | 0.17110 | 0.34220 | 0.51330 | 0.68440 | 0.85550 | 1.02660 | 1.19770 | 1.36880 | 1.53990 | 1.71100 |

## TABLE

FOR THE REDUCTION OF THE BAROMETRICAL COLUMN, MEASURED  
BY A BRASS SCALE EXTENDING FROM THE CISTERN TO THE  
TOP, TO 0° CENTIGRADE.

M. T. DELCROS. — (Guyot's Tables.)

| Height<br>of the<br>Barome-<br>ter. | Degrees, Centigrade. |        |        |        |       |       |       |       |       |
|-------------------------------------|----------------------|--------|--------|--------|-------|-------|-------|-------|-------|
|                                     | 1                    | 2      | 3      | 4      | 5     | 6     | 7     | 8     | 9     |
| mm.                                 | mm.                  | mm.    | mm.    | mm.    | mm.   | mm.   | mm.   | mm.   | mm.   |
| 665                                 | 0.1073               | 0.2146 | 0.3220 | 0.4293 | 0.537 | 0.644 | 0.751 | 0.859 | 0.966 |
| 670                                 | 0.1081               | 0.2163 | 0.3244 | 0.4326 | 0.541 | 0.649 | 0.757 | 0.865 | 0.973 |
| 675                                 | 0.1089               | 0.2179 | 0.3268 | 0.4358 | 0.545 | 0.654 | 0.763 | 0.871 | 0.980 |
| 680                                 | 0.1097               | 0.2195 | 0.3292 | 0.4390 | 0.549 | 0.658 | 0.768 | 0.878 | 0.988 |
| 685                                 | 0.1106               | 0.2211 | 0.3317 | 0.4423 | 0.553 | 0.663 | 0.774 | 0.884 | 0.995 |
| 690                                 | 0.1114               | 0.2227 | 0.3341 | 0.4455 | 0.557 | 0.668 | 0.780 | 0.891 | 1.002 |
| 695                                 | 0.1122               | 0.2243 | 0.3365 | 0.4487 | 0.561 | 0.673 | 0.785 | 0.897 | 1.010 |
| 700                                 | 0.1130               | 0.2260 | 0.3389 | 0.4520 | 0.565 | 0.678 | 0.791 | 0.904 | 1.017 |
| 705                                 | 0.1138               | 0.2276 | 0.3414 | 0.4552 | 0.569 | 0.683 | 0.797 | 0.910 | 1.024 |
| 710                                 | 0.1146               | 0.2292 | 0.3438 | 0.4584 | 0.573 | 0.688 | 0.802 | 0.917 | 1.031 |
| 715                                 | 0.1154               | 0.2308 | 0.3462 | 0.4616 | 0.577 | 0.691 | 0.808 | 0.923 | 1.039 |
| 720                                 | 0.1162               | 0.2324 | 0.3486 | 0.4648 | 0.581 | 0.697 | 0.813 | 0.930 | 1.046 |
| 725                                 | 0.1170               | 0.2340 | 0.3510 | 0.4680 | 0.585 | 0.702 | 0.819 | 0.936 | 1.053 |
| 730                                 | 0.1178               | 0.2356 | 0.3535 | 0.4713 | 0.589 | 0.707 | 0.825 | 0.943 | 1.060 |
| 735                                 | 0.1186               | 0.2372 | 0.3559 | 0.4745 | 0.593 | 0.712 | 0.830 | 0.949 | 1.068 |
| 740                                 | 0.1194               | 0.2389 | 0.3583 | 0.4777 | 0.597 | 0.717 | 0.836 | 0.955 | 1.075 |
| 745                                 | 0.1202               | 0.2405 | 0.3607 | 0.4809 | 0.601 | 0.721 | 0.842 | 0.962 | 1.082 |
| 750                                 | 0.1210               | 0.2421 | 0.3631 | 0.4842 | 0.605 | 0.726 | 0.847 | 0.968 | 1.089 |
| 755                                 | 0.1218               | 0.2437 | 0.3655 | 0.4874 | 0.609 | 0.731 | 0.853 | 0.975 | 1.097 |
| 760                                 | 0.1227               | 0.2453 | 0.3680 | 0.4906 | 0.613 | 0.736 | 0.859 | 0.981 | 1.104 |
| 765                                 | 0.1235               | 0.2469 | 0.3704 | 0.4939 | 0.617 | 0.741 | 0.864 | 0.988 | 1.111 |
| 770                                 | 0.1243               | 0.2486 | 0.3728 | 0.4971 | 0.621 | 0.746 | 0.870 | 0.994 | 1.118 |
| 775                                 | 0.1251               | 0.2502 | 0.3752 | 0.5003 | 0.625 | 0.750 | 0.876 | 1.001 | 1.126 |
| 780                                 | 0.1259               | 0.2518 | 0.3777 | 0.5036 | 0.629 | 0.755 | 0.881 | 1.007 | 1.133 |
| 785                                 | 0.1267               | 0.2534 | 0.3801 | 0.5068 | 0.633 | 0.760 | 0.888 | 1.014 | 1.140 |
| 790                                 | 0.1275               | 0.2550 | 0.3825 | 0.5100 | 0.637 | 0.765 | 0.893 | 1.020 | 1.148 |
| 795                                 | 0.1283               | 0.2566 | 0.3849 | 0.5132 | 0.641 | 0.770 | 0.898 | 1.026 | 1.155 |
| 800                                 | 0.1291               | 0.2582 | 0.3874 | 0.5165 | 0.646 | 0.775 | 0.904 | 1.033 | 1.162 |
| 805                                 | 0.1299               | 0.2598 | 0.3898 | 0.5197 | 0.650 | 0.780 | 0.909 | 1.039 | 1.169 |



## TABLE

FOR THE REDUCTION OF WATER PRESSURE TO MERCURY  
PRESSURE.

BUNSEN. — Gasometrische Methoden.

| Water<br>Pressure. | Mercury<br>Pressure. | Water<br>Pressure. | Mercury<br>Pressure. | Water<br>Pressure. | Mercury<br>Pressure. | Water<br>Pressure. | Mercury<br>Pressure. |
|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------|
| mm.                | mm.                  | mm.                | mm.                  | mm.                | mm.                  | mm.                | mm.                  |
| 1                  | 0.07                 | 29                 | 2.14                 | 56                 | 4.13                 | 83                 | 6.13                 |
| 2                  | 0.15                 | 30                 | 2.21                 | 57                 | 4.21                 | 84                 | 6.20                 |
| 3                  | 0.22                 | 31                 | 2.29                 | 58                 | 4.28                 | 85                 | 6.27                 |
| 4                  | 0.30                 | 32                 | 2.36                 | 59                 | 4.35                 | 86                 | 6.35                 |
| 5                  | 0.37                 | 33                 | 2.44                 | 60                 | 4.43                 | 87                 | 6.42                 |
| 6                  | 0.44                 | 34                 | 2.51                 | 61                 | 4.50                 | 88                 | 6.49                 |
| 7                  | 0.52                 | 35                 | 2.58                 | 62                 | 4.58                 | 89                 | 6.57                 |
| 8                  | 0.59                 | 36                 | 2.66                 | 63                 | 4.65                 | 90                 | 6.64                 |
| 9                  | 0.66                 | 37                 | 2.73                 | 64                 | 4.72                 | 91                 | 6.72                 |
| 10                 | 0.74                 | 38                 | 2.80                 | 65                 | 4.80                 | 92                 | 6.79                 |
| 11                 | 0.81                 | 39                 | 2.88                 | 66                 | 4.87                 | 93                 | 6.86                 |
| 12                 | 0.89                 | 40                 | 2.95                 | 67                 | 4.94                 | 94                 | 6.94                 |
| 13                 | 0.96                 | 41                 | 3.03                 | 68                 | 5.02                 | 95                 | 7.01                 |
| 14                 | 1.03                 | 42                 | 3.10                 | 69                 | 5.09                 | 96                 | 7.08                 |
| 15                 | 1.12                 | 43                 | 3.17                 | 70                 | 5.17                 | 97                 | 7.16                 |
| 16                 | 1.18                 | 44                 | 3.25                 | 71                 | 5.24                 | 98                 | 7.23                 |
| 17                 | 1.26                 | 45                 | 3.32                 | 72                 | 5.31                 | 99                 | 7.31                 |
| 18                 | 1.33                 | 46                 | 3.39                 | 73                 | 5.39                 | 100                | 7.38                 |
| 19                 | 1.40                 | 47                 | 3.47                 | 74                 | 5.46                 | 200                | 14.76                |
| 20                 | 1.48                 | 48                 | 3.54                 | 75                 | 5.54                 | 300                | 22.14                |
| 21                 | 1.55                 | 49                 | 3.62                 | 76                 | 5.61                 | 400                | 29.52                |
| 22                 | 1.62                 | 50                 | 3.69                 | 77                 | 5.68                 | 500                | 36.90                |
| 23                 | 1.70                 | 51                 | 3.76                 | 78                 | 5.76                 | 600                | 44.28                |
| 24                 | 1.77                 | 52                 | 3.84                 | 79                 | 5.83                 | 700                | 51.66                |
| 25                 | 1.84                 | 53                 | 3.91                 | 80                 | 5.90                 | 800                | 59.04                |
| 26                 | 1.92                 | 54                 | 3.99                 | 81                 | 5.98                 | 900                | 66.42                |
| 27                 | 1.98                 | 55                 | 4.06                 | 82                 | 6.05                 | 1000               | 73.80                |
| 28                 | 2.07                 |                    |                      |                    |                      |                    |                      |



## CORRECTION FOR THE DEPRESSION OF THE BARO-

M. T. DELCROS.—

| Radius of<br>the tube in<br>Millimetres. | Height of the Meniscus in Millimetres. |       |       |       |       |       |       |       |       |
|------------------------------------------|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                          | 0.1                                    | 0.2   | 0.3   | 0.4   | 0.5   | 0.6   | 0.7   | 0.8   | 0.9   |
| 1.0                                      | 1.268                                  | 2.460 | 3.516 | 4.396 | 5.085 |       |       |       |       |
| 1.2                                      | 0.876                                  | 1.715 | 2.484 | 3.162 | 3.728 | 4.190 |       |       |       |
| 1.4                                      | 0.638                                  | 1.256 | 1.836 | 2.363 | 2.825 | 3.218 | 3.542 |       |       |
| 1.6                                      | 0.484                                  | 0.955 | 1.404 | 1.820 | 2.196 | 2.528 | 2.812 | 3.050 |       |
| 1.8                                      | 0.378                                  | 0.747 | 1.103 | 1.437 | 1.746 | 2.024 | 2.270 | 2.483 | 2.662 |
| 2.0                                      | 0.302                                  | 0.598 | 0.885 | 1.158 | 1.413 | 1.648 | 1.859 | 2.046 | 2.209 |
| 2.2                                      | 0.245                                  | 0.487 | 0.723 | 0.948 | 1.161 | 1.360 | 1.541 | 1.705 | 1.851 |
| 2.4                                      | 0.203                                  | 0.403 | 0.599 | 0.787 | 0.966 | 1.135 | 1.292 | 1.436 | 1.565 |
| 2.6                                      | 0.170                                  | 0.337 | 0.502 | 0.661 | 0.813 | 0.958 | 1.093 | 1.218 | 1.332 |
| 2.8                                      | 0.143                                  | 0.285 | 0.425 | 0.560 | 0.691 | 0.815 | 0.932 | 1.041 | 1.142 |
| 3.0                                      | 0.122                                  | 0.243 | 0.362 | 0.478 | 0.591 | 0.698 | 0.800 | 0.896 | 0.985 |
| 3.2                                      | 0.105                                  | 0.209 | 0.312 | 0.412 | 0.509 | 0.602 | 0.691 | 0.776 | 0.855 |
| 3.4                                      | 0.091                                  | 0.181 | 0.269 | 0.356 | 0.441 | 0.523 | 0.601 | 0.675 | 0.745 |
| 3.6                                      | 0.079                                  | 0.157 | 0.234 | 0.310 | 0.384 | 0.455 | 0.524 | 0.590 | 0.652 |
| 3.8                                      | 0.069                                  | 0.137 | 0.205 | 0.271 | 0.336 | 0.399 | 0.459 | 0.517 | 0.572 |
| 4.0                                      | 0.060                                  | 0.120 | 0.180 | 0.238 | 0.295 | 0.350 | 0.404 | 0.455 | 0.504 |
| 4.2                                      | 0.053                                  | 0.106 | 0.158 | 0.210 | 0.260 | 0.309 | 0.356 | 0.402 | 0.446 |
| 4.4                                      | 0.047                                  | 0.094 | 0.140 | 0.185 | 0.230 | 0.273 | 0.315 | 0.356 | 0.395 |
| 4.6                                      | 0.042                                  | 0.083 | 0.124 | 0.164 | 0.204 | 0.242 | 0.280 | 0.316 | 0.351 |
| 4.8                                      | 0.037                                  | 0.074 | 0.110 | 0.146 | 0.181 | 0.215 | 0.249 | 0.281 | 0.312 |
| 5.0                                      | 0.033                                  | 0.065 | 0.098 | 0.130 | 0.161 | 0.192 | 0.221 | 0.250 | 0.278 |
| 5.2                                      | 0.029                                  | 0.058 | 0.087 | 0.116 | 0.144 | 0.171 | 0.198 | 0.224 | 0.248 |
| 5.4                                      | 0.026                                  | 0.052 | 0.078 | 0.103 | 0.128 | 0.153 | 0.177 | 0.200 | 0.222 |
| 5.6                                      | 0.023                                  | 0.047 | 0.070 | 0.092 | 0.115 | 0.137 | 0.158 | 0.179 | 0.199 |
| 5.8                                      | 0.021                                  | 0.042 | 0.062 | 0.083 | 0.103 | 0.122 | 0.142 | 0.160 | 0.178 |
| 6.0                                      | 0.019                                  | 0.037 | 0.056 | 0.074 | 0.092 | 0.110 | 0.127 | 0.144 | 0.160 |
| 6.2                                      | 0.017                                  | 0.034 | 0.050 | 0.067 | 0.083 | 0.099 | 0.114 | 0.129 | 0.144 |
| 6.4                                      | 0.015                                  | 0.030 | 0.045 | 0.060 | 0.074 | 0.089 | 0.103 | 0.116 | 0.130 |
| 6.6                                      | 0.014                                  | 0.027 | 0.041 | 0.054 | 0.067 | 0.080 | 0.093 | 0.105 | 0.117 |
| 6.8                                      | 0.012                                  | 0.024 | 0.037 | 0.049 | 0.061 | 0.072 | 0.084 | 0.095 | 0.105 |
| 7.0                                      | 0.011                                  | 0.022 | 0.033 | 0.044 | 0.055 | 0.065 | 0.075 | 0.085 | 0.095 |

## METRICAL COLUMN DUE TO CAPILLARY ACTION.

(Guyot's Tables.)

| Radius of<br>the tube in<br>Millimetres. | Height of the Meniscus in Millimetres. |       |       |       |       |       |       |       |       |
|------------------------------------------|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                          | 1.0                                    | 1.1   | 1.2   | 1.3   | 1.4   | 1.5   | 1.6   | 1.7   | 1.8   |
| 1.0                                      |                                        |       |       |       |       |       |       |       |       |
| 1.2                                      |                                        |       |       |       |       |       |       |       |       |
| 1.4                                      |                                        |       |       |       |       |       |       |       |       |
| 1.6                                      |                                        |       |       |       |       |       |       |       |       |
| 1.8                                      |                                        |       |       |       |       |       |       |       |       |
| 2.0                                      | 2.348                                  |       |       |       |       |       |       |       |       |
| 2.2                                      | 1.978                                  | 2.087 |       |       |       |       |       |       |       |
| 2.4                                      | 1.680                                  | 1.780 | 1.866 |       |       |       |       |       |       |
| 2.6                                      | 1.436                                  | 1.528 | 1.608 | 1.676 |       |       |       |       |       |
| 2.8                                      | 1.235                                  | 1.318 | 1.392 | 1.456 | 1.511 |       |       |       |       |
| 3.0                                      | 1.068                                  | 1.143 | 1.210 | 1.270 | 1.322 | 1.368 |       |       |       |
| 3.2                                      | 0.928                                  | 0.995 | 1.057 | 1.112 | 1.161 | 1.203 | 1.238 |       |       |
| 3.4                                      | 0.810                                  | 0.871 | 0.926 | 0.976 | 1.021 | 1.061 | 1.095 |       |       |
| 3.6                                      | 0.710                                  | 0.764 | 0.814 | 0.860 | 0.901 | 0.938 | 0.970 |       |       |
| 3.8                                      | 0.624                                  | 0.673 | 0.718 | 0.760 | 0.797 | 0.831 | 0.861 | 0.887 |       |
| 4.0                                      | 0.551                                  | 0.594 | 0.635 | 0.673 | 0.707 | 0.738 | 0.766 | 0.790 |       |
| 4.2                                      | 0.487                                  | 0.526 | 0.563 | 0.597 | 0.628 | 0.657 | 0.682 | 0.705 |       |
| 4.4                                      | 0.432                                  | 0.467 | 0.500 | 0.531 | 0.559 | 0.585 | 0.609 | 0.630 |       |
| 4.6                                      | 0.384                                  | 0.416 | 0.445 | 0.473 | 0.499 | 0.522 | 0.544 | 0.563 |       |
| 4.8                                      | 0.342                                  | 0.370 | 0.397 | 0.422 | 0.445 | 0.467 | 0.486 | 0.504 |       |
| 5.0                                      | 0.305                                  | 0.330 | 0.354 | 0.377 | 0.398 | 0.418 | 0.436 | 0.452 |       |
| 5.2                                      | 0.272                                  | 0.295 | 0.317 | 0.337 | 0.356 | 0.374 | 0.390 | 0.405 | 0.418 |
| 5.4                                      | 0.244                                  | 0.264 | 0.284 | 0.302 | 0.319 | 0.336 | 0.350 | 0.364 | 0.376 |
| 5.6                                      | 0.218                                  | 0.237 | 0.255 | 0.271 | 0.287 | 0.301 | 0.315 | 0.327 | 0.338 |
| 5.8                                      | 0.196                                  | 0.213 | 0.228 | 0.243 | 0.257 | 0.271 | 0.283 | 0.294 | 0.304 |
| 6.0                                      | 0.176                                  | 0.191 | 0.205 | 0.219 | 0.231 | 0.243 | 0.254 | 0.264 | 0.273 |
| 6.2                                      | 0.158                                  | 0.172 | 0.185 | 0.197 | 0.208 | 0.219 | 0.229 | 0.238 | 0.246 |
| 6.4                                      | 0.142                                  | 0.154 | 0.166 | 0.177 | 0.187 | 0.197 | 0.206 | 0.214 | 0.221 |
| 6.6                                      | 0.128                                  | 0.139 | 0.150 | 0.160 | 0.169 | 0.178 | 0.186 | 0.193 | 0.200 |
| 6.8                                      | 0.116                                  | 0.126 | 0.135 | 0.144 | 0.153 | 0.160 | 0.168 | 0.174 | 0.180 |
| 7.0                                      | 0.105                                  | 0.114 | 0.122 | 0.130 | 0.138 | 0.145 | 0.152 | 0.158 | 0.163 |

## TABLE

OF THE COEFFICIENTS OF ABSORPTION OF VARIOUS GASES.

BUNSEN. — Gasometrischer Tafeln.

| °C. | Nitrogen. |             | Hydrogen. |             | Oxygen.   |             |
|-----|-----------|-------------|-----------|-------------|-----------|-------------|
|     | In Water. | In Alcohol. | In Water. | In Alcohol. | In Water. | In Alcohol. |
| 0   | 0.02035   | 0.12634     | 0.01930   | 0.06925     | 0.04114   | 0.28397     |
| 1   | 0.01981   | 0.12593     | 0.01930   | 0.06910     | 0.04007   | 0.28397     |
| 2   | 0.01932   | 0.12553     | 0.01930   | 0.06896     | 0.03907   | 0.28397     |
| 3   | 0.01884   | 0.12514     | 0.01930   | 0.06881     | 0.03810   | 0.28397     |
| 4   | 0.01838   | 0.12476     | 0.01930   | 0.06867     | 0.03717   | 0.28397     |
| 5   | 0.01794   | 0.12440     | 0.01930   | 0.06853     | 0.03628   | 0.28397     |
| 6   | 0.01752   | 0.12405     | 0.01930   | 0.06839     | 0.03544   | 0.28397     |
| 7   | 0.01713   | 0.12371     | 0.01930   | 0.06826     | 0.03465   | 0.28397     |
| 8   | 0.01675   | 0.12338     | 0.01930   | 0.06813     | 0.03389   | 0.28397     |
| 9   | 0.01640   | 0.12306     | 0.01930   | 0.06799     | 0.03317   | 0.28397     |
| 10  | 0.01607   | 0.12276     | 0.01930   | 0.06786     | 0.03250   | 0.28397     |
| 11  | 0.01577   | 0.12247     | 0.01930   | 0.06774     | 0.03189   | 0.28397     |
| 12  | 0.01549   | 0.12219     | 0.01930   | 0.06761     | 0.03133   | 0.28397     |
| 13  | 0.01523   | 0.12192     | 0.01930   | 0.06749     | 0.03082   | 0.28397     |
| 14  | 0.01500   | 0.12166     | 0.01930   | 0.06737     | 0.03034   | 0.28397     |
| 15  | 0.01478   | 0.12142     | 0.01930   | 0.06725     | 0.02989   | 0.28397     |
| 16  | 0.01458   | 0.12119     | 0.01930   | 0.06713     | 0.02949   | 0.28397     |
| 17  | 0.01441   | 0.12097     | 0.01930   | 0.06701     | 0.02914   | 0.28397     |
| 18  | 0.01426   | 0.12076     | 0.01930   | 0.06690     | 0.02884   | 0.28397     |
| 19  | 0.01413   | 0.12056     | 0.01930   | 0.06679     | 0.02858   | 0.28397     |
| 20  | 0.01403   | 0.12038     | 0.01930   | 0.06668     | 0.02838   | 0.28397     |
| 21  |           | 0.12021     | 0.01930   | 0.06657     |           |             |
| 22  |           | 0.12005     | 0.01930   | 0.06646     |           |             |
| 23  |           | 0.11990     | 0.01930   | 0.06636     |           |             |
| 24  |           | 0.11976     | 0.01930   | 0.06626     |           |             |

| °C. | Carbonic Acid. |             | Carbonic Oxide. |             | Protoxide of Nitrogen. |             | Deutoxide<br>of Nitrogen<br>in Alcohol. |
|-----|----------------|-------------|-----------------|-------------|------------------------|-------------|-----------------------------------------|
|     | In Water.      | In Alcohol. | In Water.       | In Alcohol. | In Water.              | In Alcohol. |                                         |
| 0   | 1.7967         | 4.3295      | 0.03287         | 0.20443     | 1.3052                 | 4.1780      | 0.31606                                 |
| 1   | 1.7207         | 4.2368      | 0.03207         | 0.20443     | 1.2605                 | 4.1088      | 0.31262                                 |
| 2   | 1.6481         | 4.1466      | 0.03131         | 0.20443     | 1.2172                 | 4.0409      | 0.30928                                 |
| 3   | 1.5787         | 4.0589      | 0.03057         | 0.20443     | 1.1752                 | 3.9741      | 0.30604                                 |
| 4   | 1.5126         | 3.9736      | 0.02987         | 0.20443     | 1.1346                 | 3.9085      | 0.30290                                 |
| 5   | 1.4497         | 3.8908      | 0.02920         | 0.20443     | 1.0954                 | 3.8442      | 0.29985                                 |
| 6   | 1.3901         | 3.8105      | 0.02857         | 0.20443     | 1.0575                 | 3.7811      | 0.29690                                 |
| 7   | 1.3339         | 3.7327      | 0.02796         | 0.20443     | 1.0210                 | 3.7192      | 0.29405                                 |
| 8   | 1.2809         | 3.6573      | 0.02739         | 0.20443     | 0.9858                 | 3.6585      | 0.29130                                 |
| 9   | 1.2311         | 3.5844      | 0.02686         | 0.20443     | 0.9520                 | 3.5990      | 0.28865                                 |
| 10  | 1.1847         | 3.5140      | 0.02635         | 0.20443     | 0.9196                 | 3.5408      | 0.28609                                 |
| 11  | 1.1416         | 3.4461      | 0.02588         | 0.20443     | 0.8885                 | 3.4838      | 0.28363                                 |
| 12  | 1.1018         | 3.3807      | 0.02544         | 0.20443     | 0.8588                 | 3.4279      | 0.28127                                 |
| 13  | 1.0653         | 3.3178      | 0.02504         | 0.20443     | 0.8304                 | 3.3734      | 0.27901                                 |
| 14  | 1.0321         | 3.2573      | 0.02466         | 0.20443     | 0.8034                 | 3.3200      | 0.27685                                 |
| 15  | 1.0020         | 3.1993      | 0.02432         | 0.20443     | 0.7778                 | 3.2678      | 0.27478                                 |
| 16  | 0.9753         | 3.1438      | 0.02402         | 0.20443     | 0.7535                 | 3.2169      | 0.27281                                 |
| 17  | 0.9519         | 3.0908      | 0.02374         | 0.20443     | 0.7306                 | 3.1672      | 0.27094                                 |
| 18  | 0.9318         | 3.0402      | 0.02350         | 0.20443     | 0.7090                 | 3.1187      | 0.26917                                 |
| 19  | 0.9150         | 2.9921      | 0.02329         | 0.20443     | 0.6888                 | 3.0714      | 0.26750                                 |
| 20  | 0.9014         | 2.9465      | 0.02312         | 0.20443     | 0.6700                 | 3.0253      | 0.26592                                 |
| 21  |                | 2.9034      |                 |             | 0.6525                 | 2.9805      | 0.26444                                 |
| 22  |                | 2.8628      |                 |             | 0.6364                 | 2.9368      | 0.26306                                 |
| 23  |                | 2.8247      |                 |             | 0.6216                 | 2.8944      | 0.26178                                 |
| 24  |                | 2.7890      |                 |             | 0.6082                 | 2.8532      | 0.26060                                 |

| °C. | Marsh Gas. |             | Olefiant Gas. |             | Ethyl in Water. | Methyl in Water. |
|-----|------------|-------------|---------------|-------------|-----------------|------------------|
|     | In Water.  | In Alcohol. | In Water.     | In Alcohol. |                 |                  |
| 0   | 0.05449    | 0.52259     | 0.2563        | 3.5950      | 0.03147         | 0.0871           |
| 1   | 0.05332    | 0.51973     | 0.2473        | 3.5379      | 0.03040         | 0.0838           |
| 2   | 0.05217    | 0.51691     | 0.2388        | 3.4823      | 0.02947         | 0.0807           |
| 3   | 0.05104    | 0.51412     | 0.2306        | 3.4280      | 0.02856         | 0.0777           |
| 4   | 0.04993    | 0.51135     | 0.2227        | 3.3750      | 0.02770         | 0.0748           |
| 5   | 0.04885    | 0.50861     | 0.2153        | 3.3234      | 0.02689         | 0.0720           |
| 6   | 0.04778    | 0.50590     | 0.2082        | 3.2732      | 0.02613         | 0.0693           |
| 7   | 0.04674    | 0.50322     | 0.2018        | 3.2243      | 0.02541         | 0.0668           |
| 8   | 0.04571    | 0.50057     | 0.1952        | 3.1768      | 0.02474         | 0.0644           |
| 9   | 0.04470    | 0.49795     | 0.1893        | 3.1307      | 0.02412         | 0.0621           |
| 10  | 0.04372    | 0.49535     | 0.1837        | 3.0859      | 0.02355         | 0.0599           |
| 11  | 0.04275    | 0.49278     | 0.1786        | 3.0425      | 0.02303         | 0.0578           |
| 12  | 0.04180    | 0.49024     | 0.1737        | 3.0005      | 0.02257         | 0.0559           |
| 13  | 0.04088    | 0.48773     | 0.1693        | 2.9598      | 0.02216         | 0.0541           |
| 14  | 0.03997    | 0.48525     | 0.1652        | 2.9205      | 0.02179         | 0.0524           |
| 15  | 0.03909    | 0.48280     | 0.1615        | 2.8825      | 0.02147         | 0.0508           |
| 16  | 0.03823    | 0.48037     | 0.1583        | 2.8459      | 0.02121         | 0.0493           |
| 17  | 0.03739    | 0.47798     | 0.1553        | 2.8107      | 0.02100         | 0.0480           |
| 18  | 0.03657    | 0.47561     | 0.1528        | 2.7768      | 0.02084         | 0.0468           |
| 19  | 0.03577    | 0.47327     | 0.1506        | 2.7443      | 0.02073         | 0.0457           |
| 20  | 0.03499    | 0.47096     | 0.1488        | 2.7131      | 0.02065         | 0.0447           |
| 21  |            | 0.46867     |               | 2.6833      |                 |                  |
| 22  |            | 0.46642     |               | 2.6549      |                 |                  |
| 23  |            | 0.46419     |               | 2.6279      |                 |                  |
| 24  |            | 0.46199     |               | 2.6022      |                 |                  |



| °C. | Sulphuretted Hydrogen. |             | Sulphurous Acid. |             | Ammonia<br>in Water. | Atmospheric<br>Air in Water. |
|-----|------------------------|-------------|------------------|-------------|----------------------|------------------------------|
|     | In Water               | In Alcohol. | In Water.        | In Alcohol. |                      |                              |
| 0   | 4.3706                 | 17.891      | 68.861           | 328.62      | 1049.6               | 0.02471                      |
| 1   | 4.2874                 | 17.242      | 67.003           | 311.98      | 1020.8               | 0.02406                      |
| 2   | 4.2053                 | 16.606      | 65.169           | 295.97      | 993.3                | 0.02345                      |
| 3   | 4.1243                 | 15.983      | 63.360           | 280.58      | 967.0                | 0.02287                      |
| 4   | 4.0442                 | 15.373      | 61.576           | 265.81      | 941.9                | 0.02237                      |
| 5   | 3.9652                 | 14.776      | 59.816           | 241.67      | 917.9                | 0.02179                      |
| 6   | 3.8872                 | 14.193      | 58.080           | 238.16      | 895.0                | 0.02128                      |
| 7   | 3.8103                 | 13.623      | 56.369           | 225.25      | 873.1                | 0.02080                      |
| 8   | 3.7345                 | 13.066      | 54.683           | 212.98      | 852.1                | 0.02034                      |
| 9   | 3.6596                 | 12.523      | 53.021           | 201.33      | 832.0                | 0.01992                      |
| 10  | 3.5858                 | 11.992      | 51.383           | 190.31      | 812.8                | 0.01953                      |
| 11  | 3.5132                 | 11.475      | 49.770           | 179.91      | 794.3                | 0.01916                      |
| 12  | 3.4415                 | 10.971      | 48.182           | 170.13      | 776.6                | 0.01882                      |
| 13  | 3.3708                 | 10.480      | 46.618           | 160.98      | 759.6                | 0.01851                      |
| 14  | 3.3012                 | 10.003      | 45.079           | 152.45      | 743.1                | 0.01822                      |
| 15  | 3.2326                 | 9.539       | 43.564           | 144.55      | 727.2                | 0.01795                      |
| 16  | 3.1651                 | 9.088       | 42.073           | 137.27      | 711.8                | 0.01771                      |
| 17  | 3.0986                 | 8.650       | 40.608           | 130.61      | 696.9                | 0.01750                      |
| 18  | 3.0331                 | 8.225       | 39.165           | 124.58      | 682.3                | 0.01732                      |
| 19  | 2.9687                 | 7.814       | 37.749           | 119.17      | 668.0                | 0.01717                      |
| 20  | 2.9053                 | 7.415       | 36.216           | 114.48      | 654.0                | 0.01704                      |
| 21  | 2.8430                 | 7.030       | 34.986           | 110.22      | 640.2                |                              |
| 22  | 2.7817                 | 6.659       | 33.910           | 106.68      | 626.5                |                              |
| 23  | 2.7215                 | 6.300       | 32.847           | 103.77      | 613.0                |                              |
| 24  | 2.6623                 | 5.955       | 31.800           | 101.47      | 599.5                |                              |

## ESTIMATION OF THE WEIGHTS OF

| Name of Gas.             | Formulas.  | 1000 cc. | 2000 cc. | 3000 cc. |
|--------------------------|------------|----------|----------|----------|
|                          |            | Grammes. | Grammes. | Grammes. |
| Chloride of Acetyl       | $C_4H_4Cl$ | 2.79386  | 5.58772  | 8.38158  |
| Ethyl                    | $C_4H_5$   | 2.59349  | 5.18698  | 7.78047  |
| Ammonia                  | $H_3N$     | 0.76271  | 1.52542  | 2.28813  |
| Antimony                 | Sb         | 23.06332 | 46.12664 | 69.18996 |
| Antimoniuretted Hydrogen | $H_3Sb$    | 5.90026  | 11.80052 | 17.70078 |
| Arsenic                  | As         | 13.40892 | 26.81784 | 40.22676 |
| Arseniuretted Hydrogen   | $H_3As$    | 3.48665  | 6.97330  | 10.45995 |
| Boron                    | B          | 1.94876  | 3.89752  | 5.84628  |
| Chloride of Boron        | $BCl_3$    | 5.24735  | 10.49470 | 15.74205 |
| Fluoride of Boron        | $BF_3$     | 3.06166  | 6.12332  | 9.18498  |
| Bromine                  | Br         | 6.99990  | 13.99980 | 20.99970 |
| Hydrobromic Acid         | HBr        | 3.54471  | 7.08942  | 10.63413 |
| Chlorine                 | Cl         | 3.17344  | 6.34688  | 9.52032  |
| Oxychloride of Carbon    | $CClO$     | 4.42494  | 8.84988  | 13.27482 |
| Hydrochloric Acid        | HCl        | 1.63153  | 3.26306  | 4.89459  |
| Cyanogen                 | $C_2N$     | 2.32930  | 4.65860  | 6.98790  |
| Chloride of Cyanogen     | $C_2NCl$   | 2.75137  | 5.50274  | 8.25411  |
| Ditetryl                 | $C_8H_3$   | 2.50388  | 5.00776  | 7.51164  |
| Elayl                    | $C_4H_4$   | 1.25194  | 2.50388  | 3.75582  |
| Fluorine                 | Fl         | 1.71634  | 3.43268  | 5.14902  |
| Hydrofluoric Acid        | HF         | 0.90298  | 1.80596  | 2.70894  |
| Marsh gas                | $C_2H_4$   | 0.71558  | 1.43116  | 2.14674  |
| Iodine                   | I          | 11.36180 | 22.72360 | 34.08540 |
| Hydriodic Acid           | HI         | 5.72573  | 11.45146 | 17.17719 |
| Silicon                  | Si         | 3.80814  | 7.61628  | 11.42442 |
| Fluoride of Silicon      | $SiF_3$    | 4.70206  | 9.40412  | 14.10618 |
| Carbon                   | C          | 1.07272  | 2.14544  | 3.21816  |
| Carbonic Oxide           | CO         | 1.25150  | 2.50300  | 3.75450  |
| Carbonic Acid            | $CO_2$     | 1.97741  | 3.99482  | 5.93223  |
| Methyl                   | $C_2H_3$   | 1.34152  | 2.68304  | 4.02456  |
| Oxide of Methyl          | $C_2H_3O$  | 2.05669  | 4.11338  | 6.17007  |
| Chloride of Methyl       | $C_2H_3Cl$ | 2.25749  | 4.51498  | 6.77247  |
| Phosphorus               | P          | 5.54230  | 11.08460 | 16.62690 |
| Phosphuretted Hydrogen   | $H_3P$     | 1.52000  | 3.04000  | 4.56000  |

## GASES FROM THEIR VOLUMES.

| 4000 cc. | 5000 cc.  | 6000 cc.  | 7000 cc.  | 8000 cc.  | 9000 cc.  |
|----------|-----------|-----------|-----------|-----------|-----------|
| Grammes. | Grammes.  | Grammes.  | Grammes.  | Grammes.  | Grammes.  |
| 11.17544 | 13.96930  | 16.76316  | 19.55702  | 22.35088  | 25.14474  |
| 10.37396 | 12.96745  | 15.56094  | 18.15443  | 20.74792  | 23.34141  |
| 3.05084  | 3.81355   | 4.57626   | 5.33897   | 6.10168   | 6.86439   |
| 92.25328 | 115.31660 | 138.37992 | 161.44324 | 184.50656 | 207.56992 |
| 23.60104 | 29.50130  | 35.40156  | 41.30182  | 47.20208  | 53.10234  |
| 53.63568 | 67.04460  | 80.45352  | 93.86244  | 107.27136 | 120.68028 |
| 13.94660 | 17.43325  | 20.91990  | 24.40650  | 27.89320  | 31.37985  |
| 7.79504  | 9.74380   | 11.69256  | 13.64132  | 15.59008  | 17.53884  |
| 20.98940 | 26.23675  | 31.48410  | 36.73145  | 41.97880  | 47.22615  |
| 12.24664 | 15.30830  | 18.36996  | 21.43162  | 24.49328  | 27.55494  |
| 27.99960 | 34.99950  | 41.99940  | 48.99930  | 55.99920  | 62.99910  |
| 14.17884 | 17.72355  | 21.26826  | 24.81297  | 28.35768  | 31.90239  |
| 12.69376 | 15.86720  | 19.04064  | 22.21408  | 25.38752  | 28.56096  |
| 17.69976 | 22.12470  | 26.54964  | 30.97458  | 35.39952  | 39.82446  |
| 6.52612  | 8.15765   | 9.78918   | 11.42071  | 13.05224  | 14.68377  |
| 9.31720  | 11.64650  | 13.97580  | 16.30510  | 18.63440  | 20.96370  |
| 11.00548 | 13.75685  | 16.50822  | 19.25959  | 22.01096  | 24.76233  |
| 10.01552 | 12.51940  | 15.02328  | 17.52716  | 20.03104  | 22.53492  |
| 5.00776  | 6.25970   | 7.51164   | 8.76356   | 10.01552  | 11.26746  |
| 6.86536  | 8.58170   | 10.29804  | 12.01438  | 13.73072  | 15.44706  |
| 3.61192  | 4.51490   | 5.41788   | 6.32086   | 7.22384   | 8.12682   |
| 2.86232  | 3.57790   | 4.29348   | 5.00906   | 5.72464   | 6.44022   |
| 45.44720 | 56.80900  | 68.17080  | 79.53260  | 90.89440  | 102.25620 |
| 22.90292 | 28.62865  | 34.35438  | 40.08011  | 45.80584  | 51.53157  |
| 15.23256 | 19.04070  | 22.84884  | 26.65698  | 30.46512  | 34.27326  |
| 18.80824 | 23.51030  | 28.21236  | 32.91442  | 37.61648  | 42.31854  |
| 4.29088  | 5.36360   | 6.43632   | 7.50904   | 8.58176   | 9.65448   |
| 5.00600  | 6.25750   | 7.50900   | 8.76050   | 10.01200  | 11.26350  |
| 7.98964  | 9.88705   | 1.86476   | 13.84187  | 15.81928  | 17.79669  |
| 5.36608  | 6.70760   | 8.04912   | 9.39064   | 10.73216  | 12.07368  |
| 8.22676  | 10.28345  | 12.34014  | 14.39683  | 16.45352  | 18.51021  |
| 9.02996  | 11.28745  | 13.54494  | 15.80243  | 18.05992  | 20.31741  |
| 22.16920 | 27.71150  | 33.25380  | 38.79610  | 44.33840  | 49.88070  |
| 6.08000  | 7.60000   | 9.12000   | 10.64000  | 12.16000  | 13.68000  |

| Name of Gas.          | Formulas.       | 1000 cc. | 2000 cc. | 3000 cc. |
|-----------------------|-----------------|----------|----------|----------|
|                       |                 | Grammes. | Grammes. | Grammes. |
| Oxygen                | O               | 1.42980  | 2.85960  | 4.28941  |
| Sulphur               | S               | 17.16336 | 34.32672 | 51.49008 |
| Sulphurous Acid       | SO <sub>2</sub> | 2.86056  | 5.72112  | 8.58168  |
| Sulphuretted Hydrogen | HS              | 1.51991  | 3.03982  | 4.55973  |
| Selenium              | Se              | 7.02556  | 14.05112 | 21.07668 |
| Selenuretted Hydrogen | HSe             | 3.60239  | 7.20478  | 10.80717 |
| Nitrogen              | N               | 1.25618  | 2.51236  | 3.76854  |
| Deutoxide of Nitrogen | NO <sub>2</sub> | 1.34343  | 2.68686  | 4.03029  |
| Protoxide of Nitrogen | NO              | 1.97172  | 3.94344  | 5.91516  |
| Tellurium             | Te              | 11.53525 | 23.07050 | 34.60575 |
| Telluretted Hydrogen  | HTe             | 5.85723  | 11.71446 | 17.57169 |
| Water Vapor           | HO              | 0.80475  | 1.60950  | 2.41425  |
| Hydrogen              | H               | 0.08958  | 0.17916  | 0.26874  |
| Atmospheric Air       |                 | 1.29319  | 2.58638  | 3.87957  |

## ESTIMATION OF THE VOLUME OF OXYGEN

| Volume of Air.     | 100.00. | 200.00. | 300.00. |
|--------------------|---------|---------|---------|
| Volume of Nitrogen | 79.04   | 158.08  | 237.12  |
| Volume of Oxygen   | 20.96   | 41.92   | 62.88   |

| 4000 cc. | 5000 cc. | 6000 cc.  | 7000 cc.  | 8000 cc.  | 9000 cc.  |
|----------|----------|-----------|-----------|-----------|-----------|
| Grammes. | Grammes. | Grammes.  | Grammes.  | Grammes.  | Grammes.  |
| 1.71921  | 7.14901  | 8.57881   | 10.00861  | 11.41842  | 12.86822  |
| 68.65344 | 85.81680 | 102.98016 | 120.14352 | 137.30688 | 154.47024 |
| 11.44224 | 14.30280 | 17.16336  | 20.02392  | 22.88448  | 25.74504  |
| 6.07964  | 7.59955  | 9.11946   | 10.63937  | 12.15928  | 13.67919  |
| 28.10224 | 35.12780 | 42.15336  | 49.17892  | 56.20448  | 63.23004  |
| 14.40956 | 18.01195 | 21.61434  | 25.21673  | 28.81912  | 32.42151  |
| 5.02572  | 6.28090  | 7.53708   | 8.79326   | 10.04944  | 11.30562  |
| 5.37372  | 6.71615  | 8.06058   | 9.40301   | 10.74744  | 12.09087  |
| 7.88688  | 9.85860  | 11.83032  | 13.80204  | 15.77376  | 17.74548  |
| 46.14100 | 57.67625 | 69.21150  | 80.74675  | 92.28200  | 103.81725 |
| 23.42892 | 29.28615 | 35.14338  | 41.00061  | 46.85784  | 52.71507  |
| 3.21900  | 4.02375  | 4.82850   | 5.63325   | 6.43800   | 7.24275   |
| 0.35832  | 0.44790  | 0.53748   | 0.62706   | 0.71664   | 0.80622   |
| 5.17276  | 6.46595  | 7.75914   | 9.05233   | 10.34562  | 11.63871  |

## AND NITROGEN IN ATMOSPHERIC AIR.

| 400.00. | 500.00. | 600.00. | 700.00. | 800.00. | 900.00. |
|---------|---------|---------|---------|---------|---------|
| 316.16  | 395.20  | 474.24  | 553.28  | 632.32  | 711.36  |
| 83.84   | 104.80  | 125.76  | 146.72  | 167.68  | 188.64  |





T A B L E S

RELATING TO LIGHT.



## F O R M U L A S .

If  $d$  represent the density and  $n$  the index of refraction of a liquid for a given ray of light, the quantity

$$\frac{n-1}{d}$$

is found to be constant, and is termed the specific refractive power. The relation between the specific refractive power of a mixture and the specific refractive powers of its constituents is given by the equation,

$$\frac{N-1}{D} \cdot P = \frac{n-1}{d} \cdot p + \frac{n'-1}{d'} \cdot p' + \frac{n''-1}{d''} \cdot p'' + \dots$$

where,  $p$ ,  $p'$ ,  $p''$ , &c. represent the weights of the constituents in  $P$  units of weight of the mixture.

Hence, if the specific refractive power of a mixture be determined at any temperature from its index of refraction and density, and if the corresponding values are known for each constituent, the relative weights of the latter may easily be calculated when only two are present.

If  $P$  be taken as 100 we have

$$\frac{n-1}{d} \cdot p + \frac{n'-1}{d'} (100 - p) = \frac{N-1}{D} \cdot 100,$$

whence,

$$p = \frac{100 \left( \frac{N-1}{D} - \frac{n'-1}{d'} \right)}{\frac{n-1}{d} - \frac{n'-1}{d'}},$$

$$p' = 100 - p.$$

## TABLE

OF WAVE LENGTHS IN MILLIONTHS OF MILLIMETRES.

*Those marked \* are Ångström's measurements.*

DITSCHNEINER. — Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, Bd. L. Heft III. Jahrgang, 1864. Corrected according to the Wave Length of D<sub>a</sub> given by Ångström. (Pogg. Ann. CXXIII. s. 489.)

| Kirchhoff's Line. | Wave Length. | Kirchhoff's Line. | Wave Length. | Kirchhoff's Line. | Wave Length. | Kirchhoff's Line. | Wave Length. |
|-------------------|--------------|-------------------|--------------|-------------------|--------------|-------------------|--------------|
| A                 | *761.20      | 1242.6            | 557.77       | 1737.7            | 511.42       | 2221.7            | 474.34       |
| B                 | 592.7        | *687.49           | 1280.0       | 553.27            | 1750.4       | 510.30            | 2233.7       |
| C                 | 694.1        | *656.77           | 1303.5       | 551.13            | 1777.5       | 508.41            | 2250.0       |
|                   | 711.4        | 652.09            | 1306.7       | 550.70            | 1799.0       | 506.91            | 2264.3       |
|                   | 719.6        | 650.05            | 1324.8       | 548.13            | 1834.3       | 504.55            | 2309.0       |
|                   | 783.8        | 634.05            | 1337.0       | 546.78            | 1854.9       | 503.25            | 2416.0       |
|                   | 831.0        | 623.61            | 1343.5       | 546.05            | 1867.1       | 502.26            | 2436.5       |
|                   | 849.7        | 619.72            | 1351.1       | 545.08            | 1873.4       | 501.67            | 2457.5       |
|                   | 860.2        | 617.50            | 1367.0       | 543.42            | 1885.8       | 501.07            | 2467.6       |
|                   | 863.9        | 616.73            | 1389.4       | 540.91            | 1908.5       | 499.72            | 2489.4       |
|                   | 874.3        | 614.74            | 1410.5       | 538.79            | 1920.2       | 498.78            | 2537.1       |
|                   | 877.0        | 614.24            | 1421.5       | 537.52            | 1960.8       | 496.15            | 2547.2       |
|                   | 884.9        | 612.76            | 1449.4       | 534.41            | 1975.7       | 495.04            | 2566.3       |
|                   | 894.9        | 610.82            | 1463.3       | 533.29            | 1983.3       | 494.34            | 2606.6       |
|                   | 595.8        | 598.14            | 1492.4       | 530.22            | 1989.5       | 493.76            | 2627.0       |
| D <sub>β</sub>    | 1002.8       | *590.04           | 1506.3       | 528.79            | 2001.6       | 492.22            | 2638.5       |
| D <sub>γ</sub>    | 1004.8       | *589.74           | 1515.5       | 528.02            | 2018.5       | 491.41            | 2670.0       |
| D <sub>a</sub>    | 1006.8       | *589.43           | E 1523.7     | *527.38           | 2041.3       | 489.54            | 2686.6       |
|                   | 1029.3       | 586.26            | 1541.9       | 525.98            | 2058.0       | 488.18            | 2721.6       |
|                   | 1096.1       | 576.72            | 1569.6       | 523.74            | 2067.1       | 487.55            | 2734.1       |
|                   | 1102.9       | 575.78            | 1577.6       | 523.09            | F 2080.0     | *486.52           | 2775.7       |
|                   | 1135.1       | 571.51            | 1589.1       | 521.97            | 2103.3       | 484.63            | 2796.7       |
|                   | 1155.7       | 568.70            | 1601.7       | 521.32            | 2119.8       | 482.81            | 2822.3       |
|                   | 1174.2       | 566.33            | 1622.3       | 519.67            | 2148.9       | 480.56            | G 2854.7     |
|                   | 1200.6       | 562.97            | 1634.1       | 518.73            | 2157.4       | 479.55            | 2869.7       |
|                   | 1207.3       | 561.98            | b 1648.8     | 517.70            | 2160.6       | 479.23            | H *397.16    |
|                   | 1217.8       | 560.77            | 1655.6       | 517.15            | 2187.1       | 476.93            | H' *393.59   |
|                   | 1237.8       | 559.13            | 1693.8       | 514.65            | 2201.9       | 475.90            |              |



## TABLE

OF WAVE LENGTHS OF VARIOUS WELL-MARKED LINES OF THE  
SPECTRUM IN MILLIONTHS OF A MILLIMETRE.

W. GIBBS. — American Jour. of Science, XXXIX. 217.

| Line.                      | Wave Length. | Observer. | Line.                        | Wave Length. | Observer. |
|----------------------------|--------------|-----------|------------------------------|--------------|-----------|
| $\alpha$ L                 | 676.3        | Müller    | $\epsilon$ I                 | 516.7        | Plücker   |
| $\beta$ N                  | 661.0        | "         | $\gamma$ SiCl <sub>2</sub>   | 505.0        | "         |
| $\alpha$ H                 | 653.3        | Plücker   | $\beta$ H                    | 484.3        | "         |
| $\alpha$ PCl <sub>3</sub>  | 649.3        | "         | $\beta$ Br                   | 479.3        | "         |
| $\alpha$ SnCl <sub>2</sub> | 644.5        | "         | $\gamma$ Cl                  | 479.2        | "         |
| $\alpha$ SiCl <sub>2</sub> | 632.9        | "         | $\gamma$ Br                  | 476.6        | "         |
| $\alpha$ O                 | 615.0        | "         | $\delta$ Br                  | 469.1        | "         |
| 11 N                       | 608.9        | "         | $\zeta$ I                    | 466.1        | "         |
| $\beta$ PCl <sub>3</sub>   | 602.4        | "         | $\delta$ S <sub>2</sub>      | 463.1        | Müller    |
| $\beta$ SiCl <sub>2</sub>  | 597.8        | "         | $\eta$ I                     | 462.9        | Plücker   |
| $\beta$ I                  | 594.7        | "         | $\gamma$ PCl <sub>3</sub>    | 459.1        | "         |
| $\beta$ SnCl <sub>2</sub>  | 579.4        | "         | $\epsilon$ SnCl <sub>2</sub> | 452.4        | "         |
| $\alpha$ Hg                | 578.2        | "         | $\zeta$ CO <sub>2</sub>      | 450.1        | "         |
| 17 N                       | 576.2        | "         | $\theta$ I                   | 444.6        | "         |
| $\alpha$ Hg                | 575.9        | "         | $\eta$ CO <sub>2</sub>       | 438.2        | "         |
| $\gamma$ CO <sub>2</sub>   | 559.9        | "         | $\delta$ O                   | 436.7        | "         |
| $\gamma$ SnCl <sub>2</sub> | 558.4        | "         | $\gamma$ Hg                  | 435.9        | "         |
| $\beta$ Hg                 | 546.1        | "         | $\gamma$ H                   | 433.9        | "         |
| $\alpha$ Cl                | 545.1        | "         | $\epsilon$ I                 | 421.5        | "         |
| $\delta$ I                 | 533.7        | "         | L                            | 379.1        | Esselbach |
| $\delta$ SnCl <sub>2</sub> | 533.3        | "         | M                            | 365.7        | "         |
| $\beta$ O                  | 532.8        | "         | N                            | 349.8        | "         |
| $\beta$ Cl                 | 521.6        | "         | O                            | 336.0        | "         |
| $\delta$ CO <sub>2</sub>   | 519.0        | "         | P                            | 329.0        | "         |
| $\gamma$ O                 | 518.5        | "         | Q                            | 323.2        | "         |
| $\alpha$ Br                | 516.9        | "         | R                            | 309.1        | "         |

## INDICES OF

OF SOME OF THE MOST

 $\Delta$  = *The diminution in refraction for*

LANDOLT. — Pogg. Ann., Bd.

| Compounds.                  | Formula.          | Combining<br>Number.<br><i>P.</i> | Specific<br>Gravity.<br><i>d.</i> | $\mu_a$  |
|-----------------------------|-------------------|-----------------------------------|-----------------------------------|----------|
| Water                       | HO                | 9                                 | 1.0000                            | 1.331110 |
| Formic Acid $\Delta$        | $C_2H_2O_4$       | 46                                | 1.2211                            | 0.000096 |
| Acetic Acid $\Delta$        | $C_4H_4O_4$       | 60                                | 1.0514                            | 1.369270 |
| Propionic Acid $\Delta$     | $C_6H_6O_4$       | 74                                | 0.9963                            | 0.000395 |
| Butyric Acid $\Delta$       | $C_8H_8O_4$       | 88                                | 0.9610                            | 1.369850 |
| Valeric Acid $\Delta$       | $C_{10}H_{10}O_4$ | 102                               | 0.9313                            | 0.000418 |
| Capronic Acid $\Delta$      | $C_{12}H_{12}O_4$ | 116                               | 0.9252                            | 1.384600 |
| Enanthic Acid $\Delta$      | $C_{14}H_{14}O_4$ | 130                               | 0.9175                            | 0.000399 |
| Methyl Alcohol $\Delta$     | $C_3H_4O_2$       | 32                                | 0.7964                            | 1.402200 |
| Ethyl Alcohol $\Delta$      | $C_4H_6O_2$       | 46                                | 0.8011                            | 0.000406 |
| Propyl Alcohol $\Delta$     | $C_6H_8O_2$       | 60                                | 0.8042                            | 1.411640 |
| Butyl Alcohol $\Delta$      | $C_8H_{10}O_2$    | 74                                | 0.8074                            | 0.000396 |
| Amyl Alcohol $\Delta$       | $C_{10}H_{12}O_2$ | 88                                | 0.8135                            | 1.419230 |
| Acetate of Methyl $\Delta$  | $C_6H_8O_4$       | 74                                | 0.9053                            | 0.000391 |
| Formate of Ethyl $\Delta$   | $C_6H_6O_4$       | 74                                | 0.9078                            | 1.327890 |
| Acetate of Ethyl $\Delta$   | $C_8H_8O_4$       | 88                                | 0.9021                            | 0.000380 |
| Butyrate of Methyl $\Delta$ | $C_{10}H_{10}O_4$ | 102                               | 0.8976                            | 1.360540 |
|                             |                   |                                   |                                   | 0.000400 |
|                             |                   |                                   |                                   | 1.379380 |
|                             |                   |                                   |                                   | 1.393950 |
|                             |                   |                                   |                                   | 0.000390 |
|                             |                   |                                   |                                   | 1.405730 |
|                             |                   |                                   |                                   | 0.000390 |
|                             |                   |                                   |                                   | 1.359150 |
|                             |                   |                                   |                                   | 0.000520 |
|                             |                   |                                   |                                   | 1.358000 |
|                             |                   |                                   |                                   | 0.000530 |
|                             |                   |                                   |                                   | 1.370680 |
|                             |                   |                                   |                                   | 0.000500 |
|                             |                   |                                   |                                   | 1.386930 |
|                             |                   |                                   |                                   | 0.000490 |

## REFRACTION

## COMMON ORGANIC COMPOUNDS.

*an elevation of temperature of one degree.*

117, S. 353, Bd. 122, S. 545.

| $\mu_\beta$ | $\mu_\gamma$ | $A$      | $B$     | $\frac{\mu_a - 1}{d}$ | $P \left( \frac{\mu_a - 1}{d} \right)$ |
|-------------|--------------|----------|---------|-----------------------|----------------------------------------|
| 1.337120    | 1.340380     | 1.323920 | 0.30997 | 0.3311                | 5.96                                   |
| 0.000108    | 0.000110     |          |         |                       |                                        |
| 1.376430    | 1.380410     | 1.360620 | 0.37250 | 0.3024                | 13.91                                  |
| 0.000400    | 0.000433     | 0.000368 |         |                       |                                        |
| 1.376480    | 1.380170     | 1.361840 | 0.34588 | 0.3518                | 21.11                                  |
| 0.000408    | 0.000430     | 0.000409 |         |                       |                                        |
| 1.391290    | 1.395130     | 1.376430 | 0.35210 | 0.3860                | 28.57                                  |
| 0.000402    | 0.000402     | 0.000397 |         |                       |                                        |
| 1.402460    | 1.406490     | 1.387040 | 0.36614 | 0.4116                | 36.22                                  |
| 0.000419    | 0.000429     | 0.000398 |         |                       |                                        |
| 1.409310    | 1.413490     | 1.393440 | 0.37751 | 0.4319                | 44.05                                  |
| 0.000420    | 0.000423     | 0.000393 |         |                       |                                        |
| 1.419000    | 1.423230     | 1.402640 | 0.38754 | 0.4449                | 51.61                                  |
| 0.000409    | 0.000413     | 0.000380 |         |                       |                                        |
| 1.426630    | 1.431060     | 1.410050 | 0.39557 | 0.4569                | 59.40                                  |
| 0.000411    | 0.000410     | 0.000375 |         |                       |                                        |
| 1.333200    | 1.336210     | 1.321430 | 0.27821 | 0.4117                | 13.17                                  |
| 0.000400    | 0.000400     |          |         |                       |                                        |
| 1.366650    | 1.369970     | 1.353220 | 0.31532 | 0.4501                | 20.70                                  |
| 0.000410    | 0.000410     |          |         |                       |                                        |
| 1.385810    | 1.389320     | 1.371670 | 0.33238 | 0.4717                | 28.30                                  |
| 1.400690    | 1.404470     | 1.385790 | 0.35177 | 0.4879                | 36.11                                  |
| 0.000410    | 0.000410     |          |         |                       |                                        |
| 1.412780    | 1.416890     | 1.397070 | 0.37317 | 0.4987                | 43.89                                  |
| 0.000400    | 0.000420     |          |         |                       |                                        |
| 1.365390    | 1.368930     | 1.351560 | 0.32702 | 0.3967                | 29.36                                  |
| 0.000520    | 0.000530     |          |         |                       |                                        |
| 1.364200    | 1.367820     | 1.350380 | 0.32836 | 0.3944                | 29.18                                  |
| 0.000550    | 0.000570     |          |         |                       |                                        |
| 1.377090    | 1.380670     | 1.362930 | 0.33405 | 0.4109                | 36.16                                  |
| 0.000520    | 0.000540     |          |         |                       |                                        |
| 1.393590    | 1.397420     | 1.378790 | 0.35077 | 0.4311                | 43.97                                  |
| 0.000510    | 0.000520     |          |         |                       |                                        |

| Compounds.            | Formula.          | Combining<br>Number.<br><i>P.</i> | Specific<br>Gravity.<br><i>d.</i> | $\mu_a$  |
|-----------------------|-------------------|-----------------------------------|-----------------------------------|----------|
| Valerate of Methyl    | $C_{12}H_{12}O_4$ | 116                               | 0.8809                            | 1.392720 |
| Butyrate of Ethyl     | $C_{12}H_{12}O_4$ | 116                               | 0.8906                            | 1.394040 |
| Formate of Amyl       | $C_{12}H_{12}O_4$ | 116                               | 0.8816                            | 1.395920 |
| Valerate of Ethyl     | $C_{14}H_{14}O_4$ | 130                               | 0.8674                            | 1.395000 |
| Acetate of Amyl       | $C_{14}H_{14}O_4$ | 130                               | 0.8574                            | 1.401680 |
| Valerate of Amyl      | $C_{20}H_{20}O_4$ | 172                               | 0.8581                            | 1.409780 |
| Aldehyde              | $C_4H_4O_2$       | 44                                | 0.7810                            | 1.329750 |
| Valeral               | $C_{10}H_{10}O_2$ | 86                                | 0.7995                            | 1.386140 |
| Aceton                | $C_6H_6O_2$       | 58                                | 0.7931                            | 1.357150 |
| Ether                 | $C_8H_{10}O_2$    | 74                                | 0.7166                            | 1.351120 |
| Anhydrous Acetic Acid | $C_8H_6O_6$       | 102                               | 1.0836                            | 1.388320 |
| Glycol                | $C_4H_6O_4$       | 62                                | 1.1092                            | 1.425300 |
| Binacetate of Glycol  | $C_{12}H_{10}O_8$ | 146                               | 1.1583                            | 1.419320 |
| Glycerin              | $C_6H_8O_6$       | 92                                | 1.2615                            | 1.470630 |
| Lactic Acid           | $C_6H_6O_6$       | 90                                | 1.2427                            | 1.439150 |
| Phenic Acid           | $C_{12}H_6O_2$    | 94                                | 1.0722                            | 1.544470 |
| Bitter Almond Oil     | $C_{14}H_6O_2$    | 106                               | 1.0474                            | 1.539140 |
| Salicylous Acid       | $C_{14}H_6O_4$    | 122                               | 1.1693                            | 1.564670 |
| Methylsalicylic Acid  | $C_{16}H_8O_6$    | 152                               | 1.1824                            | 1.530190 |
| Benzoate of Methyl    | $C_{16}H_8O_4$    | 136                               | 1.0882                            | 1.511580 |
| Benzoate of Ethyl     | $C_{18}H_{10}O_4$ | 150                               | 1.0491                            | 1.501040 |

$\mu_a, \mu_\beta, \mu_\gamma$  = the Indices of Refraction for the three Hydrogen lines,  
*H* $\alpha$ , *H* $\beta$ , and *H* $\gamma$ .

| $\mu_\beta$ | $\mu_\gamma$ | $A$      | $B$     | $\frac{\mu_\alpha - 1}{d}$ | $P\left(\frac{\mu_\alpha - 1}{d}\right)$ |
|-------------|--------------|----------|---------|----------------------------|------------------------------------------|
| 1.399690    | 1.403700     | 1.384200 | 0.36715 | 0.4458                     | 51.71                                    |
| 0.000470    | 0.000480     |          |         |                            |                                          |
| 1.400730    | 1.404600     | 1.385800 | 0.35310 | 0.4424                     | 51.32                                    |
| 0.000490    | 0.000500     |          |         |                            |                                          |
| 1.402690    | 1.406890     | 1.387410 | 0.36682 | 0.4491                     | 52.09                                    |
| 0.000500    | 0.000510     |          |         |                            |                                          |
| 1.401870    | 1.405830     | 1.386590 | 0.36214 | 0.4554                     | 59.20                                    |
| 0.000480    | 0.000490     |          |         |                            |                                          |
| 1.408760    | 1.412710     | 1.393120 | 0.36882 | 0.4685                     | 60.90                                    |
| 0.000430    | 0.000440     |          |         |                            |                                          |
| 1.417120    | 1.421240     | 1.400890 | 0.38320 | 0.4775                     | 82.14                                    |
| 1.335880    | 1.339370     | 1.322290 | 0.32161 | 0.4222                     | 18.58                                    |
| 0.000610    | 0.000620     |          |         |                            |                                          |
| 1.393360    | 1.397290     | 1.377490 | 0.37283 | 0.4830                     | 41.54                                    |
| 0.000500    | 0.000520     |          |         |                            |                                          |
| 1.363920    | 1.367800     | 1.348880 | 0.35612 | 0.4503                     | 26.12                                    |
| 0.000540    | 0.000550     |          |         |                            |                                          |
| 1.357200    | 1.360710     | 1.343680 | 0.32067 | 0.4900                     | 36.26                                    |
| 0.000590    | 0.000590     |          |         |                            |                                          |
| 1.395250    | 1.399270     | 1.379820 | 0.36614 | 0.3584                     | 36.56                                    |
| 0.000470    | 0.000490     |          |         |                            |                                          |
| 1.432510    | 1.436620     | 1.416510 | 0.37832 | 0.3834                     | 23.77                                    |
| 0.000320    | 0.000370     |          |         |                            |                                          |
| 1.426810    | 1.431200     | 1.410100 | 0.39725 | 0.3620                     | 52.85                                    |
| 1.478450    | 1.482810     | 1.461180 | 0.40728 | 0.3731                     | 34.32                                    |
| 0.000220    | 0.000240     |          |         |                            |                                          |
| 1.446860    | 1.451350     | 1.429680 | 0.40794 | 0.3534                     | 31.81                                    |
| 0.000380    | 0.000380     |          |         |                            |                                          |
| 1.563570    | 1.575550     | 1.520350 | 1.03925 | 0.5078                     | 47.73                                    |
| 0.000440    | 0.000470     |          |         |                            |                                          |
| 1.562350    | 1.577490     | 1.509400 | 1.28201 | 0.5147                     | 54.56                                    |
| 0.000510    | 0.000540     |          |         |                            |                                          |
| 1.596000    | 1.620080     | 1.521670 | 1.85280 | 0.4829                     | 58.91                                    |
| 0.000520    | 0.000540     |          |         |                            |                                          |
| 1.552120    | 1.567180     | 1.501480 | 1.23687 | 0.4484                     | 68.16                                    |
| 0.000460    | 0.000510     |          |         |                            |                                          |
| 1.528900    | 1.539890     | 1.489610 | 0.94663 | 0.4701                     | 63.94                                    |
| 0.000490    | 0.000500     |          |         |                            |                                          |
| 1.517150    | 1.527490     | 1.480510 | 0.88444 | 0.4776                     | 71.64                                    |
| 0.000510    | 0.000550     |          |         |                            |                                          |

$A$  = Coefficient of Refraction.

$B$  = Coefficient of Dispersion in Cauchy's formula

$$\mu = A + \frac{B}{\lambda^2}.$$



## TABLE

## OF INDICES OF REFRACTION OF ESSENTIAL OILS.

GLADSTONE. — Journal of the Chemical Society of London, N. S. Vol. II. p. 1.

| Crude Oils.             | Specific Gravity<br>15.5 °C. | Refractive Indices. |        |        |         | Rotation. |
|-------------------------|------------------------------|---------------------|--------|--------|---------|-----------|
|                         |                              | Temp.               | A      | D      | H       |           |
| Anise                   | 0.9852                       | 16.5                | 1.5433 | 1.5566 | 1.6118  | — 1.0     |
| Antherosperma Moschatum | 1.0425                       | 14.0                | 1.5172 | 1.5274 | 1.5628  | + 7.0     |
| Bay                     | 0.8808                       | 18.5                | 1.4944 | 1.5022 | 1.5420  | — 6.0     |
| Bergamot                | 0.8825                       | 22.0                | 1.4559 | 1.4625 | 1.4779G | + 23.0    |
| “ Florence              | 0.8804                       | 26.5                | 1.4547 | 1.4614 | 1.4760G | + 40.0    |
| Birch Bark              | 0.9005                       | 8.0                 | 1.4851 | 1.4921 | 1.5172  | + 38.0    |
| Cajeput                 | 0.9203                       | 25.5                | 1.4561 | 1.4611 | 1.4778  | 0.0       |
| Calamus                 | 0.9388                       | 10.0                | 1.4965 | 1.5031 | 1.5204G | + 43.5    |
| “ Hamburg               | 0.9410                       | 11.0                | 1.4843 | 1.4911 | 1.5144  | + 42.0?   |
| Caraway                 | 0.8845                       | 19.0                | 1.4601 | 1.4671 | 1.4886  | + 63.0    |
| “ Hamburg 1st dist.     | 0.9121                       | 10.0                | 1.4829 | 1.4903 | 1.5142  |           |
| “ “ 2d “                | 0.8832                       | 10.5                |        | 1.4784 |         |           |
| Cascarilla              | 0.8956                       | 10.0                | 1.4844 | 1.4918 | 1.5158  | + 26.0    |
| Cassia                  | 1.0297                       | 19.5                | 1.5602 | 1.5748 | 1.6243G | 0.0       |
| Cedar                   | 0.9622                       | 23.0                | 1.4978 | 1.5035 | 1.5238  | + 3.0     |
| Cedrat                  | 0.8584                       | 18.0                | 1.4671 | 1.4731 | 1.4952  | + 156.0   |
| Citronella              | 0.8908                       | 21.0                | 1.4599 | 1.4659 | 1.4866  | — 4.0     |
| “ Penang                | 0.8847                       | 15.5                | 1.4604 | 1.4665 | 1.4875  | — 1.0     |
| Cloves                  | 1.0475                       | 17.0                | 1.5213 | 1.5312 | 1.5666  | — 4.0     |
| Coriander               | 0.8775                       | 10.0                | 1.4592 | 1.4652 | 1.4805G | + 21.0?   |
| Cubebs                  | 0.9414                       | 10.0                | 1.4953 | 1.5011 | 1.5160G |           |
| Dill                    | 0.8922                       | 11.5                | 1.4764 | 1.4834 | 1.5072  | + 206.0   |
| Elder                   | 0.8584                       | 8.5                 | 1.4686 | 1.4749 | 1.4965  | + 14.5    |
| Eucalyptus amygdalina   | 0.8812                       | 13.5                | 1.4717 | 1.4788 | 1.5021  | — 136.0   |
| “ oleosa                | 0.9322                       | 13.5                | 1.4661 | 1.4718 | 1.4909  | + 4.0     |
| Indian Geranium         | 0.9043                       | 21.5                | 1.4653 | 1.4714 | 1.4868G | — 4.0     |
| Lavender                | 0.8903                       | 20.0                | 1.4586 | 1.4648 | 1.4862  | — 20.0    |
| Lemon-grass             | 0.8932                       | 24.0                |        | 1.4705 |         | — 3.0?    |
| “ Penang                | 0.8766                       | 13.5                | 1.4756 | 1.4837 | 1.5042  | 0.0       |
| Malaleuca ericifolia    | 0.9030                       | 9.0                 | 1.4655 | 1.4712 | 1.4901  | + 26.0    |
| “ linarifolia           | 0.9016                       | 9.0                 | 1.4710 | 1.4772 | 1.4971  | + 11.0    |
| Mint                    | 0.9342                       | 19.0                | 1.4767 | 1.4840 | 1.5015G | — 116.0   |
| “                       | 0.9105                       | 14.5                | 1.4756 | 1.4822 | 1.5037  | — 13.0    |

| Crude Oils. | Specific Gravity<br>15.5 °C. | Refractive Indices. |        |        |         | Rotation. |
|-------------|------------------------------|---------------------|--------|--------|---------|-----------|
|             |                              | Temp.               | A      | D      | H       |           |
| Myrtle      | 0.8911                       | 14.0                | 1.4623 | 1.4680 | 1.4879  | + 21.0    |
| Myrrh       | 1.0189                       | 7.5                 | 1.5196 | 1.5278 | 1.5472G | -136.0    |
| Neroli      | 0.8789                       | 18.0                | 1.4614 | 1.4676 | 1.4835G | + 15.0    |
| "           | 0.8743                       | 10.0                | 1.4673 | 1.4741 | 1.4831F | + 28.0    |
| Nutmeg      | 0.8826                       | 24.0                | 1.4644 | 1.4709 | 1.4934  | + 44.0    |
| " Penang    | 0.9069                       | 16.0                | 1.4749 | 1.4818 | 1.5053  | + 9.0     |
| Orange-peel | 0.8509                       | 20.0                | 1.4633 | 1.4699 | 1.4916  | + 32.0?   |
| " Florence  | 0.8864                       | 20.0                | 1.4707 | 1.4774 | 1.4980  | + 216.0   |
| Parsley     | 0.9926                       | 8.5                 | 1.5068 | 1.5162 | 1.5417G | - 9.0     |
| Patchouli   | 0.9554                       | 21.0                | 1.4990 | 1.5050 | 1.5194G |           |
| " Penang    | 0.9592                       | 21.0                | 1.4980 | 1.5040 | 1.5183G | -120.0    |
| " French    | 1.0119                       | 14.0                | 1.5074 | 1.5132 | 1.5202F |           |
| Peppermint  | 0.9028                       | 14.5                | 1.4612 | 1.4670 | 1.4854  | - 72.0    |
| " Florence  | 0.9116                       | 14.0                | 1.4628 | 1.4682 | 1.4867  | - 44.0    |
| Petit Grain | 0.8765                       | 21.0                | 1.4536 | 1.4600 | 1.4808  | + 26.0    |
| Rose        | 0.8912                       | 25.0                | 1.4567 | 1.4627 | 1.4835  | - 7.0     |
| Rosemary    | 0.9080                       | 16.5                | 1.4632 | 1.4688 | 1.4867  | + 17.0    |
| Rosewood    | 0.9064                       | 17.0                | 1.4843 | 1.4903 | 1.5113  | - 16.0    |
| Sandalwood  | 0.9750                       | 24.0                | 1.4959 | 1.5021 | 1.5227  | - 50.0    |
| Thyme       | 0.8843                       | 19.0                | 1.4695 | 1.4754 | 1.4909G |           |
| Turpentine  | 0.8727                       | 13.0                | 1.4672 | 1.4732 | 1.4938  | - 79.0    |
| Verbena     | 0.8812                       | 20.0                | 1.4791 | 1.4870 | 1.5059G | - 6.0     |
| Wintergreen | 1.1423                       | 15.0                | 1.5163 | 1.5278 | 1.5737  | + 3.0     |
| Wormwood    | 0.9122                       | 18.0                | 1.4631 | 1.4688 | 1.4756F |           |

NOTE. — The tube by which the Angle of Rotation was determined was ten inches long. The numbers marked G and F are the indices of refraction for the lines G and F, the color of the liquid preventing H from being seen.

TABLE  
OF THE PHYSICAL PROPERTIES OF THE HYDROCARBONS OF THE  
ESSENTIAL OILS.

GLADSTONE. — Journal of the Chemical Society of London, 2d Series, Vol. II. p 1.

| Source of Hydrocarbon.    | Sp. Gr.<br>at<br>20° C.<br>= $D$ | Boil-<br>ing<br>Point. | Index of<br>Refrac-<br>tion<br>of $A$ at<br>20° C.<br>$\mu_A =$ | Dis-<br>per-<br>sion.<br>$A$ to $H$ | $\Delta 10^\circ$ | $\mu_A - 1$<br>$D$ | Rota-<br>tion. |
|---------------------------|----------------------------------|------------------------|-----------------------------------------------------------------|-------------------------------------|-------------------|--------------------|----------------|
| Orange peel               | .8460                            | 174                    | 1.4645                                                          | .0277                               | .0048             | .5490              | +154           |
| “ “ Florence              | .8468                            | 174                    | 1.4650                                                          | .0281                               | .0049             | .5491              | +260           |
| Cedrat                    | .8466                            | 173                    | 1.4650                                                          | .0280                               | .0049             | .5492              | +180           |
| Lemon                     | .8468                            | 173                    | 1.4660                                                          | .0280                               | .0049             | .5502              | +172           |
| Bergamot                  | .8466                            | 175                    | 1.4619                                                          | .0295                               | .0049             | .5456              | +76            |
| “ Florence                | .8464                            | 176                    | 1.4602                                                          | .0287                               | .0048             | .5437              | +82            |
| Neroli                    | .8466                            | 173                    | 1.4614                                                          | .0291                               | .0047             | .5450              | +76            |
| Petit Grain               | .8470                            | 174                    | 1.4617                                                          | .0282                               | .0046             | .5439              | +60            |
| Caraway Hamburg 1st dist. | .8466                            | 176                    | 1.4645                                                          | .0286                               | .0048             | .5486              | +180           |
| Dill                      | .8467                            | 173                    | 1.4646                                                          | .0288                               | .0046             | .5486              | +242           |
| Cascarilla                | .8467                            | 172                    | 1.4652                                                          | .0305                               | .0049             | .5494              | 0              |
| Elder                     | .8468                            | 172                    | 1.4631                                                          | .0269                               | .0047             | .5468              | +15            |
| Bay                       | .8508                            | 171                    | 1.4542                                                          | .0260                               | .0047             | .5338              | -22            |
| Gaultherilene             | .8510                            | 168                    | 1.4614                                                          | .0271                               | .0049             | .5422              |                |
| Nutmeg                    | .8518                            | 167                    | 1.4630                                                          | .0284                               | .0047             | .5435              | +49            |
| “ Penang                  | .8527                            | 166                    | 1.4634                                                          | .0274                               | .0049             | .5434              | +4             |
| Carvene                   | .8530                            | 166                    | 1.4610                                                          | .0261                               | .0048             | .5440              | -20            |
| “ Hamburg 2d dist.        | .8545                            |                        | 1.4641                                                          | .0263                               | .0048             | .5431              | +86            |
| Wormwood                  | .8565                            | 160                    | 1.4590                                                          | .0253                               | .0047             | .5359              | +46            |
| Terebene                  | .8583                            | 160                    | 1.4670                                                          | .0275                               | .0048             | .5440              | 0              |
| Anise                     | .8580                            | 160                    | 1.4607                                                          | .0268                               | .0047             | .5368              |                |
| Mint                      | .8600                            | 160                    | 1.4622                                                          | .0255                               | .0048             | .5374              | +30            |
| Peppermint                | .8602                            | 175                    | 1.4577                                                          | .0267                               | .0047             | .5321              | -60            |
| Laurel Turpentine         | .8618                            | 160                    | 1.4637                                                          | .0260                               | .0047             | .5380              | +94            |
| Thyme                     | .8635                            | 160                    | 1.4617                                                          | .0282                               | .0048             | .5346              | -75            |
| Turpentine I.             | .8644                            | 160                    | 1.4612                                                          | .0250                               | .0047             | .5335              | +48            |
| “ II.                     | .8555                            | 160                    | 1.4590                                                          | .0256                               | .0047             | .5365              | -87            |
| “ III.                    | .8614                            | 160                    | 1.4621                                                          | .0249                               |                   | .5364              | -90            |
| “ IV.                     | .8600                            | 160                    | 1.4613                                                          | .0254                               | .0047             | .5364              | -88            |
| Eucalyptus amygdalina     | .8642                            | 171                    | 1.4696                                                          | .0323                               | .0049             | .5434              | -142           |

| Source of Hydrocarbon. | Sp. Gr.<br>at<br>20° C.<br>= $D$ | Boil-<br>ing<br>Point. | Index of<br>Refraction<br>of $A$ at<br>20° C.<br>$\mu_A =$ | Dis-<br>per-<br>sion,<br>$A$ to $H$ | $\Delta 10^\circ$ | $\frac{\mu_A - 1}{D}$ | Rota-<br>tion. |
|------------------------|----------------------------------|------------------------|------------------------------------------------------------|-------------------------------------|-------------------|-----------------------|----------------|
| Myrtle                 | .8690                            | 163                    | 1.4565                                                     | .0248                               | .0047             | .5253                 | + 64           |
| Parsley                | .8732                            | 160                    | 1.4665                                                     | .0291                               | .0046             | .5355                 | — 44           |
| Rosemary               | .8805                            | 163                    | 1.4583                                                     | .0241                               | .0046             | .5205                 | + 8            |
| Cloves                 | .9041                            | 249                    | 1.4898                                                     | .0284                               | .0045             | .5417                 |                |
| Rosewood               | .9042                            | 249                    | 1.4878                                                     | .0277                               | .0045             | .5395                 | — 11           |
| Cubebs                 | .9062                            | 260                    | 1.4950                                                     | .0302                               | .0041             | .5462                 | + 59           |
| Calamus                | .9180                            | 260                    | 1.4930                                                     | .0322                               | .0042             | .5370                 | + 55           |
| “ Hamburg              | .9275                            | 260                    | 1.4976                                                     | .0337                               | .0043             | .5365                 | + 22           |
| Cascarilla             | .9212                            | 254                    | 1.4926                                                     | .0307                               | .0042             | .5347                 | + 72           |
| Patchouli              | .9211                            | 254                    | 1.4966                                                     | .0274                               | .0042             | .5391                 |                |
| “ Penang               | .9278                            | 257                    | 1.4963                                                     | .0275                               | .0044             | .5349                 | — 90           |
| “ French               | .9255                            | 260                    | 1.5009                                                     | .0262                               | .0042             | .5412                 |                |
| Colophene              | .9391                            | 315                    | 1.5084                                                     | .0309                               | .0041             | .5413                 | 0              |





MISCELLANEOUS.



## SOLUBILITIES OF SOME OF THE MORE COMMON PRECIPITATES.

FRESENIUS. — *Quan. Analysis*, pp. 740-749.

**Bichloride of Potassium and Platinum.** — In absence of free Hydrochloric acid one part of the salt dissolves in 12083 parts of alcohol of 97.5 per cent, in 3775, of 76 per cent, and in 1053, of 55 per cent. In presence of free Hydrochloric acid, in 1835, of 76 per cent.

**Bichloride of Ammonium and Platinum.** — In absence of free Hydrochloric acid, one part of the salt dissolves in 26535 parts of alcohol of 97.5 per cent, in 1406 parts of alcohol of 76 per cent, in 665 parts of alcohol of 55 per cent. In presence of free Hydrochloric acid, one part of the salt requires 672 parts of spirit of 76 per cent.

**Carbonate of Barium.** — One part dissolves in 14137 parts of water at 15-20°. One part dissolves in 15432 parts of boiling water. One part dissolves in 141000 parts of water containing Ammonia, Carbonate of Ammonium, and Chloride of Ammonium.

**Fluosilicate of Barium.** — One part of the salt requires 3802 parts of cold, or 3392 parts of boiling water for solution. One part of the salt requires from 640 to 733 parts of water acidified with Hydrochloric for solution.

**Sulphate of Strontium.** — One part of the salt dissolves in 6895 parts of water at 14°, in 9638 parts of boiling water, in 11862 parts of water containing Sulphuric and Hydrochloric acids, in 432 parts of Nitric acid of 4.8 per cent, in 474 parts of Hydrochloric of 8.5 per cent, and in 7843 parts of Acetic acid of 15.6 per cent.

**Carbonate of Strontium.** — One part of the salt requires 18045 parts of cold water for solution, and 56545 parts of a solution containing Carbonate of Ammonium and free Ammonia.

**Carbonate of Calcium.** — One part dissolves in 8834 parts of boiling, or in 10601 parts of cold water. One part requires 65246 parts of a solution of Carbonate of Ammonium and free Ammonia to dissolve it.

**Basic Phosphate of Magnesium and Ammonium.** — One part dissolves in 15293 parts of pure water, in 44600 parts of water containing free Ammonia, in 7548 parts of water containing Chloride of Ammonium, and in 15627 parts of water containing Chloride of Ammonium and Ammonia.

**Magnesia.** — One part dissolves in 55368 parts of water.

**Basic Carbonate of Zinc.** — One part dissolves in 44642 parts of water.

**Carbonate of Lead.** — One part requires 50551 parts of water, or 23450 parts of a dilute solution of Acetate of Ammonium, Carbonate of Ammonium, and Ammonia for Solution.

**Sulphate of Lead.** — One part dissolves in 22816 parts of pure water, and in 36504 parts of water containing Sulphuric acid.

## WEIGHTS AND MEASURES.

### FRENCH WEIGHTS AND MEASURES.

#### *Measure of Length.*

|                |   |       |         |
|----------------|---|-------|---------|
| One Myriametre | = | 10000 | Metres. |
| “ Kilometre    | = | 1000  | “       |
| “ Hectometre   | = | 100   | “       |
| “ Decametre    | = | 10    | “       |
| “ Metre        | = | 1     | “       |
| “ Decimetre    | = | 0.1   | “       |
| “ Centimetre   | = | 0.01  | “       |
| “ Millimetre   | = | 0.001 | “       |

#### *Square Measure.*

|              |   |        |               |
|--------------|---|--------|---------------|
| One Centiare | = | 1      | Square Metre. |
| “ Are        | = | 100    | “ Metres.     |
| “ Hectare    | = | 10,000 | “ “           |

#### *Cubic Measure.*

|                 |   |               |              |
|-----------------|---|---------------|--------------|
| One Cubic Metre | = | 1             | Cubic Metre. |
| “ “ Decimetre   | = | 0.001         | “            |
| “ “ Centimetre  | = | 0.000,001     | “            |
| “ “ Millimetre  | = | 0.000,000,001 | “            |
| One Litre       | = | 1000          | c.c.         |

#### *Weights.*

|                |   |       |          |
|----------------|---|-------|----------|
| One Kilogramme | = | 1000  | Grammes. |
| “ Hectogramme  | = | 100   | “        |
| “ Decagramme   | = | 10    | “        |
| “ Gramme       | = | 1     | “        |
| “ Decigramme   | = | 0.1   | “        |
| “ Centigramme  | = | 0.01  | “        |
| “ Milligramme  | = | 0.001 | “        |

One Gramme = 15.4336 Grains = one Cubic Centimetre of water at 3.9° C. and 760 m.m. pressure.



VALUES OF ENGLISH WEIGHTS AND MEASURES IN FRENCH OR  
DECIMAL.

*Wine Measure.*

|               |   |        |                    |
|---------------|---|--------|--------------------|
| One Gallon    | = | 4.5435 | Litres.            |
| “ Quart       | = | 1.1359 | “                  |
| “ Pint        | = | .5679  | “                  |
| “ Gill        | = | .1420  | “                  |
| “ Fluid Ounce | = | 28.4   | Cubic Centimetres. |

*Long Measure.*

|           |   |           |              |
|-----------|---|-----------|--------------|
| One Mile  | = | 1609.4083 | Metres.      |
| “ Furlong | = | 201.1760  | “            |
| “ Rod     | = | 5.0297    | “            |
| “ Yard    | = | .9144     | “            |
| “ Foot    | = | .3048     | “            |
| “ Inch    | = | 2.54      | Centimetres. |
| “ Line    | = | .21       | “            |

*Square Measure.*

|                 |   |          |                |
|-----------------|---|----------|----------------|
| One Square Mile | = | 258.9894 | Hectares.      |
| “ “ Acre        | = | 40.4671  | Ares.          |
| “ “ Rood        | = | 10.1168  | “              |
| “ “ Rod         | = | 25.292   | Square Metres. |
| “ “ Yard        | = | 0.8360   | “ “            |
| “ “ Foot        | = | .0929    | “ “            |
| “ “ Inch        | = | 6.45     | “ Centimetres. |

*Cubic Measure.*

|                |   |            |                    |
|----------------|---|------------|--------------------|
| One Cubic Foot | = | 28315.3119 | Cubic Centimetres. |
| “ “ Inch       | = | 16.3862    | “ “                |

*Avoirdupois Weight.*

|                          |   |           |              |
|--------------------------|---|-----------|--------------|
| One Ton, 2000 lbs.,      | = | 907.18530 | Kilogrammes. |
| “ Hundred Wt., 100 lbs., | = | 45.359265 | “            |
| “ Pound                  | = | .45359265 | “            |
| “ Ounce                  | = | 28.3494   | Grammes.     |
| “ Dram                   | = | 1.7718    | “            |

*Troy Weight.*

|               |   |         |          |
|---------------|---|---------|----------|
| One Pound     | = | 373.242 | Grammes. |
| “ Ounce       | = | 31.1035 | “        |
| “ Pennyweight | = | 1.5522  | “        |
| “ Grain       | = | .0648   | “        |

*Apothecaries' Weight.*

|           |   |         |          |
|-----------|---|---------|----------|
| One Pound | = | 373.242 | Grammes. |
| “ Ounce   | = | 31.1035 | “        |
| “ Dram    | = | 3.8779  | “        |
| “ Scruple | = | 1.296   | “        |
| “ Grain   | = | .0648   | “        |



# TABLE OF LOGARITHMS.





TABLE  
OF LOGARITHMS FROM 1 TO 100.

|    |         |    |         |    |         |     |         |
|----|---------|----|---------|----|---------|-----|---------|
| 1  | 0.00000 | 26 | 1.41497 | 51 | 1.70757 | 76  | 1.88081 |
| 2  | 0.30103 | 27 | 1.43136 | 52 | 1.71600 | 77  | 1.88649 |
| 3  | 0.47712 | 28 | 1.44716 | 53 | 1.72428 | 78  | 1.89209 |
| 4  | 0.60206 | 29 | 1.46240 | 54 | 1.73239 | 79  | 1.89763 |
| 5  | 0.69897 | 30 | 1.47712 | 55 | 1.74036 | 80  | 1.90309 |
| 6  | 0.77815 | 31 | 1.49136 | 56 | 1.74819 | 81  | 1.90849 |
| 7  | 0.84510 | 32 | 1.50515 | 57 | 1.75587 | 82  | 1.91381 |
| 8  | 0.90309 | 33 | 1.51851 | 58 | 1.76343 | 83  | 1.91908 |
| 9  | 0.95424 | 34 | 1.53148 | 59 | 1.77085 | 84  | 1.92428 |
| 10 | 1.00000 | 35 | 1.54407 | 60 | 1.77815 | 85  | 1.92942 |
| 11 | 1.04139 | 36 | 1.55630 | 61 | 1.78533 | 86  | 1.93450 |
| 12 | 1.07918 | 37 | 1.56820 | 62 | 1.79239 | 87  | 1.93952 |
| 13 | 1.11394 | 38 | 1.57978 | 63 | 1.79934 | 88  | 1.94448 |
| 14 | 1.14613 | 39 | 1.59106 | 64 | 1.80618 | 89  | 1.94939 |
| 15 | 1.17609 | 40 | 1.60206 | 65 | 1.81291 | 90  | 1.95424 |
| 16 | 1.20412 | 41 | 1.61278 | 66 | 1.81954 | 91  | 1.95904 |
| 17 | 1.23045 | 42 | 1.62325 | 67 | 1.82607 | 92  | 1.96379 |
| 18 | 1.25527 | 43 | 1.63347 | 68 | 1.83251 | 93  | 1.96848 |
| 19 | 1.27875 | 44 | 1.64345 | 69 | 1.83885 | 94  | 1.97313 |
| 20 | 1.30103 | 45 | 1.65321 | 70 | 1.84510 | 95  | 1.97772 |
| 21 | 1.32222 | 46 | 1.66276 | 71 | 1.85126 | 96  | 1.98227 |
| 22 | 1.34242 | 47 | 1.67210 | 72 | 1.85733 | 97  | 1.98677 |
| 23 | 1.36173 | 48 | 1.68124 | 73 | 1.86332 | 98  | 1.99123 |
| 24 | 1.38021 | 49 | 1.69020 | 74 | 1.86923 | 99  | 1.99564 |
| 25 | 1.39794 | 50 | 1.69897 | 75 | 1.87506 | 100 | 2.00000 |

NOTE. — In the following table the two leading figures in the first column of Logarithms are to be prefixed to all the numbers of the same horizontal line in the next nine columns, but when an asterisk (\*) occurs, the two leading figures are to be taken from the next lower line.

|     | 0     | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|-----|-------|------|------|------|------|------|------|------|------|------|
| 100 | 00000 | 043  | 087  | 130  | 173  | 217  | 260  | 303  | 346  | 389  |
| 101 | 432   | 475  | 518  | 561  | 604  | 647  | 689  | 732  | 775  | 817  |
| 102 | 860   | 903  | 945  | 988  | *030 | *072 | *115 | *157 | *199 | *242 |
| 103 | 01284 | 326  | 368  | 410  | 452  | 494  | 536  | 578  | 620  | 662  |
| 104 | 703   | 745  | 787  | 828  | 870  | 912  | 953  | 995  | *036 | *078 |
| 105 | 02119 | 160  | 202  | 243  | 284  | 325  | 366  | 407  | 449  | 490  |
| 106 | 531   | 572  | 612  | 653  | 694  | 735  | 776  | 816  | 857  | 898  |
| 107 | 938   | 979  | *019 | *060 | *100 | *141 | *181 | *222 | *262 | *302 |
| 108 | 03342 | 383  | 423  | 463  | 503  | 543  | 583  | 623  | 663  | 703  |
| 109 | 743   | 782  | 822  | 862  | 902  | 941  | 981  | *021 | *060 | *100 |
| 110 | 04139 | 179  | 218  | 258  | 297  | 336  | 376  | 415  | 454  | 493  |
| 111 | 532   | 571  | 610  | 650  | 689  | 727  | 766  | 805  | 844  | 883  |
| 112 | 922   | 961  | 999  | *038 | *077 | *115 | *154 | *192 | *231 | *269 |
| 113 | 05308 | 346  | 385  | 423  | 461  | 500  | 538  | 576  | 614  | 652  |
| 114 | 690   | 729  | 767  | 805  | 843  | 881  | 918  | 956  | 994  | *032 |
| 115 | 06070 | 108  | 145  | 183  | 221  | 258  | 296  | 333  | 371  | 408  |
| 116 | 446   | 483  | 521  | 558  | 595  | 633  | 670  | 707  | 744  | 781  |
| 117 | 819   | 856  | 893  | 930  | 967  | *004 | *041 | *078 | *115 | *151 |
| 118 | 07188 | 225  | 262  | 298  | 335  | 372  | 408  | 445  | 482  | 518  |
| 119 | 555   | 591  | 628  | 664  | 700  | 737  | 773  | 809  | 846  | 882  |
| 120 | 918   | 954  | 990  | *027 | *063 | *099 | *135 | *171 | *207 | *243 |
| 121 | 08279 | 314  | 350  | 386  | 422  | 458  | 493  | 529  | 565  | 600  |
| 122 | 636   | 672  | 707  | 743  | 778  | 814  | 849  | 884  | 920  | 955  |
| 123 | 991   | *026 | *061 | *096 | *132 | *167 | *202 | *237 | *272 | *307 |
| 124 | 09342 | 377  | 412  | 447  | 482  | 517  | 552  | 587  | 621  | 656  |
| 125 | 691   | 726  | 760  | 795  | 830  | 864  | 899  | 934  | 968  | *003 |
| 126 | 10037 | 072  | 106  | 140  | 175  | 209  | 243  | 278  | 312  | 346  |
| 127 | 380   | 415  | 449  | 483  | 517  | 551  | 585  | 619  | 653  | 687  |
| 128 | 721   | 755  | 789  | 823  | 857  | 890  | 924  | 958  | 992  | *025 |
| 129 | 11059 | 093  | 126  | 160  | 193  | 227  | 261  | 294  | 327  | 361  |
| 130 | 394   | 428  | 461  | 494  | 528  | 561  | 594  | 628  | 661  | 694  |
| 131 | 727   | 760  | 793  | 826  | 860  | 893  | 926  | 959  | 992  | *024 |
| 132 | 12057 | 090  | 123  | 156  | 189  | 222  | 254  | 287  | 320  | 352  |
| 133 | 385   | 418  | 450  | 483  | 516  | 548  | 581  | 613  | 646  | 678  |
| 134 | 710   | 743  | 775  | 808  | 840  | 872  | 905  | 937  | 969  | *001 |
| 135 | 13033 | 066  | 098  | 130  | 162  | 194  | 226  | 258  | 290  | 322  |
| 136 | 354   | 386  | 418  | 450  | 481  | 513  | 545  | 577  | 609  | 640  |
| 137 | 672   | 704  | 735  | 767  | 799  | 830  | 862  | 893  | 925  | 956  |
| 138 | 988   | *019 | *051 | *082 | *114 | *145 | *176 | *208 | *239 | *270 |
| 139 | 14301 | 333  | 364  | 395  | 426  | 457  | 489  | 520  | 551  | 582  |

|     | 0     | 1   | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|-----|-------|-----|------|------|------|------|------|------|------|------|
| 140 | 14613 | 644 | 675  | 706  | 737  | 768  | 799  | 829  | 860  | 891  |
| 141 | 922   | 953 | 983  | *014 | *045 | *076 | *106 | *137 | *168 | *198 |
| 142 | 15229 | 259 | 290  | 320  | 351  | 381  | 412  | 442  | 473  | 503  |
| 143 | 534   | 564 | 594  | 625  | 655  | 685  | 715  | 746  | 776  | 806  |
| 144 | 836   | 866 | 897  | 927  | 957  | 987  | *017 | *047 | *077 | *107 |
| 145 | 16137 | 167 | 197  | 227  | 256  | 286  | 316  | 346  | 376  | 406  |
| 146 | 435   | 465 | 495  | 524  | 554  | 584  | 613  | 643  | 673  | 702  |
| 147 | 732   | 761 | 791  | 820  | 850  | 879  | 909  | 938  | 967  | 997  |
| 148 | 17026 | 056 | 085  | 114  | 143  | 173  | 202  | 231  | 260  | 289  |
| 149 | 319   | 348 | 377  | 406  | 435  | 464  | 493  | 522  | 551  | 580  |
| 150 | 609   | 638 | 667  | 696  | 725  | 754  | 782  | 811  | 840  | 869  |
| 151 | 898   | 926 | 955  | 984  | *013 | *041 | *070 | *099 | *127 | *156 |
| 152 | 18184 | 213 | 241  | 270  | 298  | 327  | 355  | 384  | 412  | 441  |
| 153 | 469   | 498 | 526  | 554  | 583  | 611  | 639  | 667  | 696  | 724  |
| 154 | 752   | 780 | 808  | 837  | 865  | 893  | 921  | 949  | 977  | *005 |
| 155 | 19033 | 061 | 089  | 117  | 145  | 173  | 201  | 229  | 257  | 285  |
| 156 | 312   | 340 | 368  | 396  | 424  | 451  | 479  | 507  | 535  | 562  |
| 157 | 590   | 618 | 645  | 673  | 700  | 728  | 756  | 783  | 811  | 838  |
| 158 | 866   | 893 | 921  | 948  | 976  | *003 | *030 | *058 | *085 | *112 |
| 159 | 20140 | 167 | 194  | 222  | 249  | 276  | 303  | 330  | 358  | 385  |
| 160 | 412   | 439 | 466  | 493  | 520  | 548  | 575  | 602  | 629  | 656  |
| 161 | 683   | 710 | 737  | 763  | 790  | 817  | 844  | 871  | 898  | 925  |
| 162 | 952   | 978 | *005 | *032 | *059 | *085 | *112 | *139 | *165 | *192 |
| 163 | 21219 | 245 | 272  | 299  | 325  | 352  | 378  | 405  | 431  | 458  |
| 164 | 484   | 511 | 537  | 564  | 590  | 617  | 643  | 669  | 696  | 722  |
| 165 | 748   | 775 | 801  | 827  | 854  | 880  | 906  | 932  | 958  | 985  |
| 166 | 22011 | 037 | 063  | 089  | 115  | 141  | 167  | 194  | 220  | 246  |
| 167 | 272   | 298 | 324  | 350  | 376  | 401  | 427  | 453  | 479  | 505  |
| 168 | 531   | 557 | 583  | 608  | 634  | 660  | 686  | 712  | 737  | 763  |
| 169 | 789   | 814 | 840  | 866  | 891  | 917  | 943  | 968  | 994  | *019 |
| 170 | 23045 | 070 | 096  | 121  | 147  | 172  | 198  | 223  | 249  | 274  |
| 171 | 300   | 325 | 350  | 376  | 401  | 426  | 452  | 477  | 502  | 528  |
| 172 | 553   | 578 | 603  | 629  | 654  | 679  | 704  | 729  | 754  | 779  |
| 173 | 805   | 830 | 855  | 880  | 905  | 930  | 955  | 980  | *005 | *030 |
| 174 | 24055 | 080 | 105  | 130  | 155  | 180  | 204  | 229  | 254  | 279  |
| 175 | 304   | 329 | 353  | 378  | 403  | 428  | 452  | 477  | 502  | 527  |
| 176 | 551   | 576 | 601  | 625  | 650  | 674  | 699  | 724  | 748  | 773  |
| 177 | 797   | 822 | 846  | 871  | 895  | 920  | 944  | 969  | 993  | *018 |
| 178 | 25042 | 066 | 091  | 115  | 139  | 164  | 188  | 212  | 237  | 261  |
| 179 | 285   | 310 | 334  | 358  | 382  | 406  | 431  | 455  | 479  | 503  |

|     | 0     | 1   | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|-----|-------|-----|------|------|------|------|------|------|------|------|
| 180 | 25527 | 551 | 575  | 600  | 624  | 648  | 672  | 696  | 720  | 744  |
| 181 | 768   | 792 | 816  | 840  | 864  | 888  | 912  | 935  | 959  | 983  |
| 182 | 26007 | 081 | 055  | 079  | 102  | 126  | 150  | 174  | 198  | 221  |
| 183 | 245   | 269 | 293  | 316  | 340  | 364  | 387  | 411  | 435  | 458  |
| 184 | 482   | 505 | 529  | 553  | 576  | 600  | 623  | 647  | 670  | 694  |
| 185 | 717   | 741 | 764  | 788  | 811  | 834  | 858  | 881  | 905  | 928  |
| 186 | 951   | 975 | 998  | *021 | *045 | *068 | *091 | *114 | *138 | *161 |
| 187 | 27184 | 207 | 231  | 254  | 277  | 300  | 323  | 346  | 370  | 393  |
| 188 | 416   | 439 | 462  | 485  | 508  | 531  | 554  | 577  | 600  | 623  |
| 189 | 646   | 669 | 692  | 715  | 738  | 761  | 784  | 807  | 830  | 852  |
| 190 | 875   | 898 | 921  | 944  | 967  | 989  | *012 | *035 | *058 | *081 |
| 191 | 28103 | 126 | 149  | 171  | 194  | 217  | 240  | 262  | 285  | 307  |
| 192 | 330   | 353 | 375  | 398  | 421  | 443  | 466  | 488  | 511  | 533  |
| 193 | 556   | 578 | 601  | 623  | 646  | 668  | 691  | 713  | 735  | 758  |
| 194 | 780   | 803 | 825  | 847  | 870  | 892  | 914  | 937  | 959  | 981  |
| 195 | 29003 | 026 | 048  | 070  | 092  | 115  | 137  | 159  | 181  | 203  |
| 196 | 226   | 248 | 270  | 292  | 314  | 336  | 358  | 380  | 403  | 425  |
| 197 | 447   | 469 | 491  | 513  | 535  | 557  | 579  | 601  | 623  | 645  |
| 198 | 667   | 688 | 710  | 732  | 754  | 776  | 798  | 820  | 842  | 863  |
| 199 | 885   | 907 | 929  | 951  | 973  | 994  | *016 | *038 | *060 | *081 |
| 200 | 30103 | 125 | 146  | 168  | 190  | 211  | 233  | 255  | 276  | 298  |
| 201 | 320   | 341 | 363  | 384  | 406  | 428  | 449  | 471  | 492  | 514  |
| 202 | 535   | 557 | 578  | 600  | 621  | 643  | 664  | 685  | 707  | 728  |
| 203 | 750   | 771 | 792  | 814  | 835  | 856  | 878  | 899  | 920  | 942  |
| 204 | 963   | 984 | *006 | *027 | *048 | *069 | *091 | *112 | *133 | *154 |
| 205 | 31175 | 197 | 218  | 239  | 260  | 281  | 302  | 323  | 345  | 366  |
| 206 | 387   | 408 | 429  | 450  | 471  | 492  | 513  | 534  | 555  | 576  |
| 207 | 597   | 618 | 639  | 660  | 681  | 702  | 723  | 744  | 765  | 785  |
| 208 | 806   | 827 | 848  | 869  | 890  | 911  | 931  | 952  | 973  | 994  |
| 209 | 32015 | 035 | 056  | 077  | 098  | 118  | 139  | 160  | 181  | 201  |
| 210 | 222   | 243 | 263  | 284  | 305  | 325  | 346  | 366  | 387  | 408  |
| 211 | 428   | 449 | 469  | 490  | 510  | 531  | 552  | 572  | 593  | 613  |
| 212 | 634   | 654 | 675  | 695  | 715  | 736  | 756  | 777  | 797  | 818  |
| 213 | 838   | 858 | 879  | 899  | 919  | 940  | 960  | 980  | *001 | *021 |
| 214 | 33041 | 062 | 082  | 102  | 122  | 143  | 163  | 183  | 203  | 224  |
| 215 | 244   | 264 | 284  | 304  | 325  | 345  | 365  | 385  | 405  | 425  |
| 216 | 445   | 465 | 486  | 506  | 526  | 546  | 566  | 586  | 606  | 626  |
| 217 | 646   | 666 | 686  | 706  | 726  | 746  | 766  | 786  | 806  | 826  |
| 218 | 846   | 866 | 885  | 905  | 925  | 945  | 965  | 985  | *005 | *025 |
| 219 | 34044 | 064 | 084  | 104  | 124  | 143  | 163  | 183  | 203  | 223  |



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|-----|-------|------|------|------|------|------|------|------|------|------|
| 220 | 34242 | 262  | 282  | 301  | 321  | 341  | 361  | 380  | 400  | 420  |
| 221 | 439   | 459  | 479  | 498  | 518  | 537  | 557  | 577  | 596  | 616  |
| 222 | 635   | 655  | 674  | 694  | 713  | 733  | 753  | 772  | 792  | 811  |
| 223 | 830   | 850  | 869  | 889  | 908  | 928  | 947  | 967  | 986  | *005 |
| 224 | 35025 | 044  | 064  | 083  | 102  | 122  | 141  | 160  | 180  | 199  |
| 225 | 218   | 238  | 257  | 276  | 295  | 315  | 334  | 353  | 372  | 392  |
| 226 | 411   | 430  | 449  | 468  | 488  | 507  | 526  | 545  | 564  | 583  |
| 227 | 603   | 622  | 641  | 660  | 679  | 698  | 717  | 736  | 755  | 774  |
| 228 | 793   | 813  | 832  | 851  | 870  | 889  | 908  | 927  | 946  | 965  |
| 229 | 984   | *003 | *021 | *040 | *059 | *078 | *097 | *116 | *135 | *154 |
| 230 | 36173 | 192  | 211  | 229  | 248  | 267  | 286  | 305  | 324  | 342  |
| 231 | 361   | 380  | 399  | 418  | 436  | 455  | 474  | 493  | 511  | 530  |
| 232 | 549   | 568  | 586  | 605  | 624  | 642  | 661  | 680  | 698  | 717  |
| 233 | 736   | 754  | 773  | 791  | 810  | 829  | 847  | 866  | 884  | 903  |
| 234 | 922   | 940  | 959  | 977  | 996  | *014 | *033 | *051 | *070 | *088 |
| 235 | 37107 | 125  | 144  | 162  | 181  | 199  | 218  | 236  | 254  | 273  |
| 236 | 291   | 310  | 328  | 346  | 365  | 383  | 401  | 420  | 438  | 457  |
| 237 | 475   | 493  | 511  | 530  | 548  | 566  | 585  | 603  | 621  | 639  |
| 238 | 658   | 676  | 694  | 712  | 731  | 749  | 767  | 785  | 803  | 822  |
| 239 | 840   | 858  | 876  | 894  | 912  | 931  | 949  | 967  | 985  | *003 |
| 240 | 38021 | 039  | 057  | 075  | 093  | 112  | 130  | 148  | 166  | 184  |
| 241 | 202   | 220  | 238  | 256  | 274  | 292  | 310  | 328  | 346  | 364  |
| 242 | 382   | 399  | 417  | 435  | 453  | 471  | 489  | 507  | 525  | 543  |
| 243 | 561   | 578  | 596  | 614  | 632  | 650  | 668  | 686  | 703  | 721  |
| 244 | 739   | 757  | 775  | 792  | 810  | 828  | 846  | 863  | 881  | 899  |
| 245 | 917   | 934  | 952  | 970  | 987  | *005 | *023 | *041 | *058 | *076 |
| 246 | 39094 | 111  | 129  | 146  | 164  | 182  | 199  | 217  | 235  | 252  |
| 247 | 270   | 287  | 305  | 322  | 340  | 358  | 375  | 393  | 410  | 428  |
| 248 | 445   | 463  | 480  | 498  | 515  | 533  | 550  | 568  | 585  | 602  |
| 249 | 620   | 637  | 655  | 672  | 690  | 707  | 724  | 742  | 759  | 777  |
| 250 | 794   | 811  | 829  | 846  | 863  | 881  | 898  | 915  | 933  | 950  |
| 251 | 967   | 985  | *002 | *019 | *037 | *054 | *071 | *088 | *106 | *123 |
| 252 | 40140 | 157  | 175  | 192  | 209  | 226  | 243  | 261  | 278  | 295  |
| 253 | 312   | 329  | 346  | 364  | 381  | 398  | 415  | 432  | 449  | 466  |
| 254 | 483   | 500  | 518  | 535  | 552  | 569  | 586  | 603  | 620  | 637  |
| 255 | 654   | 671  | 688  | 705  | 722  | 739  | 756  | 773  | 790  | 807  |
| 256 | 824   | 841  | 858  | 875  | 892  | 909  | 926  | 943  | 960  | 976  |
| 257 | 993   | *010 | *027 | *044 | *061 | *078 | *095 | *111 | *128 | *145 |
| 258 | 41162 | 179  | 196  | 212  | 229  | 246  | 263  | 280  | 296  | 313  |
| 259 | 330   | 347  | 363  | 380  | 397  | 414  | 430  | 447  | 464  | 481  |



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|-----|-------|------|------|------|------|------|------|------|------|------|
| 260 | 41497 | 514  | 531  | 547  | 564  | 581  | 597  | 614  | 631  | 647  |
| 261 | 664   | 681  | 697  | 714  | 731  | 747  | 764  | 780  | 797  | 814  |
| 262 | 830   | 847  | 863  | 880  | 896  | 913  | 929  | 946  | 963  | 979  |
| 263 | 996   | *012 | *029 | *045 | *062 | *078 | *095 | *111 | *127 | *144 |
| 264 | 42160 | 177  | 193  | 210  | 226  | 243  | 259  | 275  | 292  | 308  |
| 265 | 325   | 341  | 357  | 374  | 390  | 406  | 423  | 439  | 455  | 472  |
| 266 | 488   | 504  | 521  | 537  | 553  | 570  | 586  | 602  | 619  | 635  |
| 267 | 651   | 667  | 684  | 700  | 716  | 732  | 749  | 765  | 781  | 797  |
| 268 | 813   | 830  | 846  | 862  | 878  | 894  | 911  | 927  | 943  | 959  |
| 269 | 975   | 991  | *008 | *024 | *040 | *056 | *072 | *088 | *104 | *120 |
| 270 | 43136 | 152  | 169  | 185  | 201  | 217  | 233  | 249  | 265  | 281  |
| 271 | 297   | 313  | 329  | 345  | 361  | 377  | 393  | 409  | 425  | 441  |
| 272 | 457   | 473  | 489  | 505  | 521  | 537  | 553  | 569  | 584  | 600  |
| 273 | 616   | 632  | 648  | 664  | 680  | 696  | 712  | 727  | 743  | 759  |
| 274 | 775   | 791  | 807  | 823  | 838  | 854  | 870  | 886  | 902  | 917  |
| 275 | 933   | 949  | 965  | 981  | 996  | *012 | *028 | *044 | *059 | *075 |
| 276 | 44091 | 107  | 122  | 138  | 154  | 170  | 185  | 201  | 217  | 232  |
| 277 | 248   | 264  | 279  | 295  | 311  | 326  | 342  | 358  | 373  | 389  |
| 278 | 404   | 420  | 436  | 451  | 467  | 483  | 498  | 514  | 529  | 545  |
| 279 | 560   | 576  | 592  | 607  | 623  | 638  | 654  | 669  | 685  | 700  |
| 280 | 716   | 731  | 747  | 762  | 778  | 793  | 809  | 824  | 840  | 855  |
| 281 | 871   | 886  | 902  | 917  | 932  | 948  | 963  | 979  | 994  | *010 |
| 282 | 45025 | 040  | 056  | 071  | 086  | 102  | 117  | 133  | 148  | 163  |
| 283 | 179   | 194  | 209  | 225  | 240  | 255  | 271  | 286  | 301  | 317  |
| 284 | 332   | 347  | 362  | 378  | 393  | 408  | 423  | 439  | 454  | 469  |
| 285 | 484   | 500  | 515  | 530  | 545  | 561  | 576  | 591  | 606  | 621  |
| 286 | 637   | 652  | 667  | 682  | 697  | 712  | 728  | 743  | 758  | 773  |
| 287 | 788   | 803  | 818  | 834  | 849  | 864  | 879  | 894  | 909  | 924  |
| 288 | 939   | 954  | 969  | 984  | *000 | *015 | *030 | *045 | *060 | *075 |
| 289 | 46090 | 105  | 120  | 135  | 150  | 165  | 180  | 195  | 210  | 225  |
| 290 | 240   | 255  | 270  | 285  | 300  | 315  | 330  | 345  | 359  | 374  |
| 291 | 389   | 404  | 419  | 434  | 449  | 464  | 479  | 494  | 509  | 523  |
| 292 | 538   | 553  | 568  | 583  | 598  | 613  | 627  | 642  | 657  | 672  |
| 293 | 687   | 702  | 716  | 731  | 746  | 761  | 776  | 790  | 805  | 820  |
| 294 | 835   | 850  | 864  | 879  | 894  | 909  | 923  | 938  | 953  | 967  |
| 295 | 982   | 997  | *012 | *026 | *041 | *056 | *070 | *085 | *100 | *114 |
| 296 | 47129 | 144  | 159  | 173  | 188  | 202  | 217  | 232  | 246  | 261  |
| 297 | 276   | 290  | 305  | 319  | 334  | 349  | 363  | 378  | 392  | 407  |
| 298 | 422   | 436  | 451  | 465  | 480  | 494  | 509  | 524  | 538  | 553  |
| 299 | 567   | 582  | 596  | 611  | 625  | 640  | 654  | 669  | 683  | 698  |

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|-----|-------|------|------|------|------|------|------|------|------|------|
| 300 | 47712 | 727  | 741  | 756  | 770  | 784  | 799  | 813  | 828  | 842  |
| 301 | 857   | 871  | 885  | 900  | 914  | 929  | 943  | 958  | 972  | 986  |
| 302 | 48001 | 015  | 029  | 044  | 058  | 073  | 087  | 101  | 116  | 130  |
| 303 | 144   | 159  | 173  | 187  | 202  | 216  | 230  | 244  | 259  | 273  |
| 304 | 287   | 302  | 316  | 330  | 344  | 359  | 373  | 387  | 401  | 416  |
| 305 | 430   | 444  | 458  | 473  | 487  | 501  | 515  | 530  | 544  | 558  |
| 306 | 572   | 586  | 601  | 615  | 629  | 643  | 657  | 671  | 686  | 700  |
| 307 | 714   | 728  | 742  | 756  | 770  | 785  | 799  | 813  | 827  | 841  |
| 308 | 855   | 869  | 883  | 897  | 911  | 926  | 940  | 954  | 968  | 982  |
| 309 | 996   | *010 | *024 | *038 | *052 | *066 | *080 | *094 | *108 | *122 |
| 310 | 49136 | 150  | 164  | 178  | 192  | 206  | 220  | 234  | 248  | 262  |
| 311 | 276   | 290  | 304  | 318  | 332  | 346  | 360  | 374  | 388  | 402  |
| 312 | 415   | 429  | 443  | 457  | 471  | 485  | 499  | 513  | 527  | 541  |
| 313 | 554   | 568  | 582  | 596  | 610  | 624  | 638  | 651  | 665  | 679  |
| 314 | 693   | 707  | 721  | 734  | 748  | 762  | 776  | 790  | 803  | 817  |
| 315 | 831   | 845  | 859  | 872  | 886  | 900  | 914  | 927  | 941  | 955  |
| 316 | 969   | 982  | 996  | *010 | *024 | *037 | *051 | *065 | *079 | *092 |
| 317 | 50106 | 120  | 133  | 147  | 161  | 174  | 188  | 202  | 215  | 229  |
| 318 | 243   | 256  | 270  | 284  | 297  | 311  | 325  | 338  | 352  | 365  |
| 319 | 379   | 393  | 406  | 420  | 433  | 447  | 461  | 474  | 488  | 501  |
| 320 | 515   | 529  | 542  | 556  | 569  | 583  | 596  | 610  | 623  | 637  |
| 321 | 651   | 664  | 678  | 691  | 705  | 718  | 732  | 745  | 759  | 772  |
| 322 | 786   | 799  | 813  | 826  | 840  | 853  | 866  | 880  | 893  | 907  |
| 323 | 920   | 934  | 947  | 961  | 974  | 987  | *001 | *014 | *028 | *041 |
| 324 | 51055 | 068  | 081  | 095  | 108  | 121  | 135  | 148  | 162  | 175  |
| 325 | 188   | 202  | 215  | 228  | 242  | 255  | 268  | 282  | 295  | 308  |
| 326 | 322   | 335  | 348  | 362  | 375  | 388  | 402  | 415  | 428  | 441  |
| 327 | 455   | 468  | 481  | 495  | 508  | 521  | 534  | 548  | 561  | 574  |
| 328 | 587   | 601  | 614  | 627  | 640  | 654  | 667  | 680  | 693  | 706  |
| 329 | 720   | 733  | 746  | 759  | 772  | 786  | 799  | 812  | 825  | 838  |
| 330 | 851   | 865  | 878  | 891  | 904  | 917  | 930  | 943  | 957  | 970  |
| 331 | 983   | 996  | *009 | *022 | *035 | *048 | *061 | *075 | *088 | *101 |
| 332 | 52114 | 127  | 140  | 153  | 166  | 179  | 192  | 205  | 218  | 231  |
| 333 | 244   | 257  | 270  | 284  | 297  | 310  | 323  | 336  | 349  | 362  |
| 334 | 375   | 388  | 401  | 414  | 427  | 440  | 453  | 466  | 479  | 492  |
| 335 | 504   | 517  | 530  | 543  | 556  | 569  | 582  | 595  | 608  | 621  |
| 336 | 634   | 647  | 660  | 673  | 686  | 699  | 711  | 724  | 737  | 750  |
| 337 | 763   | 776  | 789  | 802  | 815  | 827  | 840  | 853  | 866  | 879  |
| 338 | 892   | 905  | 917  | 930  | 943  | 956  | 969  | 982  | 994  | *007 |
| 339 | 53020 | 033  | 046  | 058  | 071  | 084  | 097  | 110  | 122  | 135  |

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|-----|-------|------|------|------|------|------|------|------|------|------|
| 340 | 53148 | 161  | 173  | 186  | 199  | 212  | 224  | 237  | 250  | 263  |
| 341 | 275   | 288  | 301  | 314  | 326  | 339  | 352  | 364  | 377  | 390  |
| 342 | 403   | 415  | 428  | 441  | 453  | 466  | 479  | 491  | 504  | 517  |
| 343 | 529   | 542  | 555  | 567  | 580  | 593  | 605  | 618  | 631  | 643  |
| 344 | 656   | 668  | 681  | 694  | 706  | 719  | 732  | 744  | 757  | 769  |
| 345 | 782   | 794  | 807  | 820  | 832  | 845  | 857  | 870  | 882  | 895  |
| 346 | 908   | 920  | 933  | 945  | 958  | 970  | 983  | 995  | *008 | *020 |
| 347 | 54033 | 045  | 058  | 070  | 083  | 095  | 108  | 120  | 133  | 145  |
| 348 | 158   | 170  | 183  | 195  | 208  | 220  | 233  | 245  | 258  | 270  |
| 349 | 283   | 295  | 307  | 320  | 332  | 345  | 357  | 370  | 382  | 394  |
| 350 | 407   | 419  | 432  | 444  | 456  | 469  | 481  | 494  | 506  | 518  |
| 351 | 531   | 543  | 555  | 568  | 580  | 593  | 605  | 617  | 630  | 642  |
| 352 | 654   | 667  | 679  | 691  | 704  | 716  | 728  | 741  | 753  | 765  |
| 353 | 777   | 790  | 802  | 814  | 827  | 839  | 851  | 864  | 876  | 888  |
| 354 | 900   | 913  | 925  | 937  | 949  | 962  | 974  | 986  | 998  | *011 |
| 355 | 55023 | 035  | 047  | 060  | 072  | 084  | 096  | 108  | 121  | 133  |
| 356 | 145   | 157  | 169  | 182  | 194  | 206  | 218  | 230  | 242  | 255  |
| 357 | 267   | 279  | 291  | 303  | 315  | 328  | 340  | 352  | 364  | 376  |
| 358 | 388   | 400  | 413  | 425  | 437  | 449  | 461  | 473  | 485  | 497  |
| 359 | 509   | 522  | 534  | 546  | 558  | 570  | 582  | 594  | 606  | 618  |
| 360 | 630   | 642  | 654  | 666  | 678  | 691  | 703  | 715  | 727  | 739  |
| 361 | 751   | 763  | 775  | 787  | 799  | 811  | 823  | 835  | 847  | 859  |
| 362 | 871   | 883  | 895  | 907  | 919  | 931  | 943  | 955  | 967  | 979  |
| 363 | 991   | *003 | *015 | *027 | *038 | *050 | *062 | *074 | *086 | *098 |
| 364 | 56110 | 122  | 134  | 146  | 158  | 170  | 182  | 194  | 205  | 217  |
| 365 | 229   | 241  | 253  | 265  | 277  | 289  | 301  | 312  | 324  | 336  |
| 366 | 348   | 360  | 372  | 384  | 396  | 407  | 419  | 431  | 443  | 455  |
| 367 | 467   | 478  | 490  | 502  | 514  | 526  | 538  | 549  | 561  | 573  |
| 368 | 585   | 597  | 608  | 620  | 632  | 644  | 656  | 667  | 679  | 691  |
| 369 | 703   | 714  | 726  | 738  | 750  | 761  | 773  | 785  | 797  | 808  |
| 370 | 820   | 832  | 844  | 855  | 867  | 879  | 891  | 902  | 914  | 926  |
| 371 | 937   | 949  | 961  | 972  | 984  | 996  | *008 | *019 | *031 | *043 |
| 372 | 57054 | 066  | 078  | 089  | 101  | 113  | 124  | 136  | 148  | 159  |
| 373 | 171   | 183  | 194  | 206  | 217  | 229  | 241  | 252  | 264  | 276  |
| 374 | 287   | 299  | 310  | 322  | 334  | 345  | 357  | 368  | 380  | 392  |
| 375 | 403   | 415  | 426  | 438  | 449  | 461  | 473  | 484  | 496  | 507  |
| 376 | 519   | 530  | 542  | 553  | 565  | 576  | 588  | 600  | 611  | 623  |
| 377 | 634   | 646  | 657  | 669  | 680  | 692  | 703  | 715  | 726  | 738  |
| 378 | 749   | 761  | 772  | 784  | 795  | 807  | 818  | 830  | 841  | 852  |
| 379 | 864   | 875  | 887  | 898  | 910  | 921  | 933  | 944  | 955  | 967  |

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|-----|-------|------|------|------|------|------|------|------|------|------|
| 380 | 57978 | 990  | *001 | *013 | *024 | *035 | *047 | *058 | *070 | *081 |
| 381 | 58092 | 104  | 115  | 127  | 138  | 149  | 161  | 172  | 184  | 195  |
| 382 | 206   | 218  | 229  | 240  | 252  | 263  | 274  | 286  | 297  | 309  |
| 383 | 320   | 331  | 343  | 354  | 365  | 377  | 388  | 399  | 410  | 422  |
| 384 | 433   | 444  | 456  | 467  | 478  | 490  | 501  | 512  | 524  | 535  |
| 385 | 546   | 557  | 569  | 580  | 591  | 602  | 614  | 625  | 636  | 647  |
| 386 | 659   | 670  | 681  | 692  | 704  | 715  | 726  | 737  | 749  | 760  |
| 387 | 771   | 782  | 794  | 805  | 816  | 827  | 838  | 850  | 861  | 872  |
| 388 | 883   | 894  | 906  | 917  | 928  | 939  | 950  | 961  | 973  | 984  |
| 389 | 995   | *006 | *017 | *028 | *040 | *051 | *062 | *073 | *084 | *095 |
| 390 | 59106 | 118  | 129  | 140  | 151  | 162  | 173  | 184  | 195  | 207  |
| 391 | 218   | 229  | 240  | 251  | 262  | 273  | 284  | 295  | 306  | 318  |
| 392 | 329   | 340  | 351  | 362  | 373  | 384  | 395  | 406  | 417  | 428  |
| 393 | 439   | 450  | 461  | 472  | 483  | 494  | 506  | 517  | 528  | 539  |
| 394 | 550   | 561  | 572  | 583  | 594  | 605  | 616  | 627  | 638  | 649  |
| 395 | 660   | 671  | 682  | 693  | 704  | 715  | 726  | 737  | 748  | 759  |
| 396 | 770   | 780  | 791  | 802  | 813  | 824  | 835  | 846  | 857  | 868  |
| 397 | 879   | 890  | 901  | 912  | 923  | 934  | 945  | 956  | 966  | 977  |
| 398 | 988   | 999  | *010 | *021 | *032 | *043 | *054 | *065 | *076 | *086 |
| 399 | 60097 | 108  | 119  | 130  | 141  | 152  | 163  | 173  | 184  | 195  |
| 400 | 206   | 217  | 228  | 239  | 249  | 260  | 271  | 282  | 293  | 304  |
| 401 | 314   | 325  | 336  | 347  | 358  | 369  | 379  | 390  | 401  | 412  |
| 402 | 423   | 433  | 444  | 455  | 466  | 477  | 487  | 498  | 509  | 520  |
| 403 | 531   | 541  | 552  | 563  | 574  | 584  | 595  | 606  | 617  | 627  |
| 404 | 638   | 649  | 660  | 670  | 681  | 692  | 703  | 713  | 724  | 735  |
| 405 | 746   | 756  | 767  | 778  | 788  | 799  | 810  | 821  | 831  | 842  |
| 406 | 853   | 863  | 874  | 885  | 895  | 906  | 917  | 927  | 938  | 949  |
| 407 | 959   | 970  | 981  | 991  | *002 | *013 | *023 | *034 | *045 | *055 |
| 408 | 61066 | 077  | 087  | 098  | 109  | 119  | 130  | 140  | 151  | 162  |
| 409 | 172   | 183  | 194  | 204  | 215  | 225  | 236  | 247  | 257  | 268  |
| 410 | 278   | 289  | 300  | 310  | 321  | 331  | 342  | 352  | 363  | 374  |
| 411 | 384   | 395  | 405  | 416  | 426  | 437  | 448  | 458  | 469  | 479  |
| 412 | 490   | 500  | 511  | 521  | 532  | 542  | 553  | 563  | 574  | 584  |
| 413 | 595   | 606  | 616  | 627  | 637  | 648  | 658  | 669  | 679  | 690  |
| 414 | 700   | 711  | 721  | 731  | 742  | 752  | 763  | 773  | 784  | 794  |
| 415 | 805   | 815  | 826  | 836  | 847  | 857  | 868  | 878  | 888  | 899  |
| 416 | 909   | 920  | 930  | 941  | 951  | 962  | 972  | 982  | 993  | *003 |
| 417 | 62014 | 024  | 034  | 045  | 055  | 066  | 076  | 086  | 097  | 107  |
| 418 | 118   | 128  | 138  | 149  | 159  | 170  | 180  | 190  | 201  | 211  |
| 419 | 221   | 232  | 242  | 252  | 263  | 273  | 284  | 294  | 304  | 315  |



|     | 0     | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|-----|-------|------|------|------|------|------|------|------|------|------|
| 420 | 62325 | 335  | 346  | 356  | 366  | 377  | 387  | 397  | 408  | 418  |
| 421 | 428   | 439  | 449  | 459  | 469  | 480  | 490  | 500  | 511  | 521  |
| 422 | 531   | 542  | 552  | 562  | 572  | 583  | 593  | 603  | 613  | 624  |
| 423 | 634   | 644  | 655  | 665  | 675  | 685  | 696  | 706  | 716  | 726  |
| 424 | 737   | 747  | 757  | 767  | 778  | 788  | 798  | 808  | 818  | 829  |
| 425 | 839   | 849  | 859  | 870  | 880  | 890  | 900  | 910  | 921  | 931  |
| 426 | 941   | 951  | 961  | 972  | 982  | 992  | *002 | *012 | *022 | *033 |
| 427 | 63043 | 053  | 063  | 073  | 083  | 094  | 104  | 114  | 124  | 134  |
| 428 | 144   | 155  | 165  | 175  | 185  | 195  | 205  | 215  | 225  | 236  |
| 429 | 246   | 256  | 266  | 276  | 286  | 296  | 306  | 317  | 327  | 337  |
| 430 | 347   | 357  | 367  | 377  | 387  | 397  | 407  | 417  | 428  | 438  |
| 431 | 448   | 458  | 468  | 478  | 488  | 498  | 508  | 518  | 528  | 538  |
| 432 | 548   | 558  | 568  | 579  | 589  | 599  | 609  | 619  | 629  | 639  |
| 433 | 649   | 659  | 669  | 679  | 689  | 699  | 709  | 719  | 729  | 739  |
| 434 | 749   | 759  | 769  | 779  | 789  | 799  | 809  | 819  | 829  | 839  |
| 435 | 849   | 859  | 869  | 879  | 889  | 899  | 909  | 919  | 929  | 939  |
| 436 | 949   | 959  | 969  | 979  | 988  | 998  | *008 | *018 | *028 | *038 |
| 437 | 64048 | 058  | 068  | 078  | 088  | 098  | 108  | 118  | 128  | 137  |
| 438 | 147   | 157  | 167  | 177  | 187  | 197  | 207  | 217  | 227  | 237  |
| 439 | 246   | 256  | 266  | 276  | 286  | 296  | 306  | 316  | 326  | 335  |
| 440 | 345   | 355  | 365  | 375  | 385  | 395  | 404  | 414  | 424  | 434  |
| 441 | 444   | 454  | 464  | 473  | 483  | 493  | 503  | 513  | 523  | 532  |
| 442 | 542   | 552  | 562  | 572  | 582  | 591  | 601  | 611  | 621  | 631  |
| 443 | 640   | 650  | 660  | 670  | 680  | 689  | 699  | 709  | 719  | 729  |
| 444 | 738   | 748  | 758  | 768  | 777  | 787  | 797  | 807  | 816  | 826  |
| 445 | 836   | 846  | 856  | 865  | 875  | 885  | 895  | 904  | 914  | 924  |
| 446 | 933   | 943  | 953  | 963  | 972  | 982  | 992  | *002 | *011 | *021 |
| 447 | 65031 | 040  | 050  | 060  | 070  | 079  | 089  | 099  | 108  | 118  |
| 448 | 128   | 137  | 147  | 157  | 167  | 176  | 186  | 196  | 205  | 215  |
| 449 | 225   | 234  | 244  | 254  | 263  | 273  | 283  | 292  | 302  | 312  |
| 450 | 321   | 331  | 341  | 350  | 360  | 369  | 379  | 389  | 398  | 408  |
| 451 | 418   | 427  | 437  | 447  | 456  | 466  | 475  | 485  | 495  | 504  |
| 452 | 514   | 523  | 533  | 543  | 552  | 562  | 571  | 581  | 591  | 600  |
| 453 | 610   | 619  | 629  | 639  | 648  | 658  | 667  | 677  | 686  | 696  |
| 454 | 706   | 715  | 725  | 734  | 744  | 753  | 763  | 772  | 782  | 792  |
| 455 | 801   | 811  | 820  | 830  | 839  | 849  | 858  | 868  | 877  | 887  |
| 456 | 896   | 906  | 916  | 925  | 935  | 944  | 954  | 963  | 973  | 982  |
| 457 | 992   | *001 | *011 | *020 | *030 | *039 | *049 | *058 | *068 | *077 |
| 458 | 66087 | 096  | 106  | 115  | 124  | 134  | 143  | 153  | 162  | 172  |
| 459 | 181   | 191  | 200  | 210  | 219  | 229  | 238  | 247  | 257  | 266  |



|     | 0     | 1   | 2   | 3   | 4   | 5   | 6   | 7    | 8    | 9    |
|-----|-------|-----|-----|-----|-----|-----|-----|------|------|------|
| 460 | 66276 | 285 | 295 | 304 | 314 | 323 | 332 | 342  | 351  | 361  |
| 461 | 370   | 380 | 389 | 398 | 403 | 417 | 427 | 436  | 445  | 455  |
| 462 | 464   | 474 | 483 | 492 | 502 | 511 | 521 | 530  | 539  | 549  |
| 463 | 558   | 567 | 577 | 586 | 596 | 605 | 614 | 624  | 633  | 642  |
| 464 | 652   | 661 | 671 | 680 | 689 | 699 | 708 | 717  | 727  | 736  |
| 465 | 745   | 755 | 764 | 773 | 783 | 792 | 801 | 811  | 820  | 829  |
| 466 | 839   | 848 | 857 | 867 | 876 | 885 | 894 | 904  | 913  | 922  |
| 467 | 932   | 941 | 950 | 960 | 969 | 978 | 987 | 997  | *006 | *015 |
| 468 | 67025 | 034 | 043 | 052 | 062 | 071 | 080 | 089  | 099  | 108  |
| 469 | 117   | 127 | 136 | 145 | 154 | 164 | 173 | 182  | 191  | 201  |
| 470 | 210   | 219 | 228 | 237 | 247 | 256 | 265 | 274  | 284  | 293  |
| 471 | 302   | 311 | 321 | 330 | 339 | 348 | 357 | 367  | 376  | 385  |
| 472 | 394   | 403 | 413 | 422 | 431 | 440 | 449 | 459  | 468  | 477  |
| 473 | 486   | 495 | 504 | 514 | 523 | 532 | 541 | 550  | 560  | 569  |
| 474 | 578   | 587 | 596 | 605 | 614 | 624 | 633 | 642  | 651  | 660  |
| 475 | 669   | 679 | 688 | 697 | 706 | 715 | 724 | 733  | 742  | 752  |
| 476 | 761   | 770 | 779 | 788 | 797 | 806 | 815 | 825  | 834  | 843  |
| 477 | 852   | 861 | 870 | 879 | 888 | 897 | 906 | 916  | 925  | 934  |
| 478 | 943   | 952 | 961 | 970 | 979 | 988 | 997 | *006 | *015 | *024 |
| 479 | 68034 | 043 | 052 | 061 | 070 | 079 | 088 | 097  | 106  | 115  |
| 480 | 124   | 133 | 142 | 151 | 160 | 169 | 178 | 187  | 196  | 205  |
| 481 | 215   | 224 | 233 | 242 | 251 | 260 | 269 | 278  | 287  | 296  |
| 482 | 305   | 314 | 323 | 332 | 341 | 350 | 359 | 368  | 377  | 386  |
| 483 | 395   | 404 | 413 | 422 | 431 | 440 | 449 | 458  | 467  | 476  |
| 484 | 485   | 494 | 502 | 511 | 520 | 529 | 538 | 547  | 556  | 565  |
| 485 | 574   | 583 | 592 | 601 | 610 | 619 | 628 | 637  | 646  | 655  |
| 486 | 664   | 673 | 681 | 690 | 699 | 708 | 717 | 726  | 735  | 744  |
| 487 | 753   | 762 | 771 | 780 | 789 | 797 | 806 | 815  | 824  | 833  |
| 488 | 842   | 851 | 860 | 869 | 878 | 886 | 895 | 904  | 913  | 922  |
| 489 | 931   | 940 | 949 | 958 | 966 | 975 | 984 | 993  | *002 | *011 |
| 490 | 69020 | 028 | 037 | 046 | 055 | 064 | 073 | 082  | 090  | 099  |
| 491 | 108   | 117 | 126 | 135 | 144 | 152 | 161 | 170  | 179  | 188  |
| 492 | 197   | 205 | 214 | 223 | 232 | 241 | 249 | 258  | 267  | 276  |
| 493 | 285   | 294 | 302 | 311 | 320 | 329 | 338 | 346  | 355  | 364  |
| 494 | 373   | 381 | 390 | 399 | 408 | 417 | 425 | 434  | 443  | 452  |
| 495 | 461   | 469 | 478 | 487 | 496 | 504 | 513 | 522  | 531  | 539  |
| 496 | 548   | 557 | 566 | 574 | 583 | 592 | 601 | 609  | 618  | 627  |
| 497 | 636   | 644 | 653 | 662 | 671 | 679 | 688 | 697  | 705  | 714  |
| 498 | 723   | 732 | 740 | 749 | 758 | 767 | 775 | 784  | 793  | 801  |
| 499 | 810   | 819 | 827 | 836 | 845 | 854 | 862 | 871  | 880  | 888  |

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|-----|-------|------|------|------|------|------|------|------|------|------|
| 500 | 69897 | 906  | 914  | 923  | 932  | 940  | 949  | 958  | 966  | 975  |
| 501 | 984   | 992  | *001 | *010 | *018 | *027 | *036 | *044 | *053 | *062 |
| 502 | 70070 | 079  | 088  | 096  | 105  | 114  | 122  | 131  | 140  | 148  |
| 503 | 157   | 165  | 174  | 183  | 191  | 200  | 209  | 217  | 226  | 234  |
| 504 | 243   | 252  | 260  | 269  | 278  | 286  | 295  | 303  | 312  | 321  |
| 505 | 329   | 338  | 346  | 355  | 364  | 372  | 381  | 389  | 398  | 406  |
| 506 | 415   | 424  | 432  | 441  | 449  | 458  | 467  | 475  | 484  | 492  |
| 507 | 501   | 509  | 518  | 526  | 535  | 544  | 552  | 561  | 569  | 578  |
| 508 | 586   | 595  | 603  | 612  | 621  | 629  | 638  | 646  | 655  | 663  |
| 509 | 672   | 680  | 689  | 697  | 706  | 714  | 723  | 731  | 740  | 749  |
| 510 | 757   | 766  | 774  | 783  | 791  | 800  | 808  | 817  | 825  | 834  |
| 511 | 842   | 851  | 859  | 868  | 876  | 885  | 893  | 902  | 910  | 919  |
| 512 | 927   | 935  | 944  | 952  | 961  | 969  | 978  | 986  | 995  | *003 |
| 513 | 71012 | 020  | 029  | 037  | 046  | 054  | 063  | 071  | 079  | 088  |
| 514 | 096   | 105  | 113  | 122  | 130  | 139  | 147  | 155  | 164  | 172  |
| 515 | 181   | 189  | 198  | 206  | 214  | 223  | 231  | 240  | 248  | 257  |
| 516 | 265   | 273  | 282  | 290  | 299  | 307  | 315  | 324  | 332  | 341  |
| 517 | 349   | 357  | 366  | 374  | 383  | 391  | 399  | 408  | 416  | 425  |
| 518 | 433   | 441  | 450  | 458  | 466  | 475  | 483  | 492  | 500  | 508  |
| 519 | 517   | 525  | 533  | 542  | 550  | 559  | 567  | 575  | 584  | 592  |
| 520 | 600   | 609  | 617  | 625  | 634  | 642  | 650  | 659  | 667  | 675  |
| 521 | 684   | 692  | 700  | 709  | 717  | 725  | 734  | 742  | 750  | 759  |
| 522 | 767   | 775  | 784  | 792  | 800  | 809  | 817  | 825  | 834  | 842  |
| 523 | 850   | 858  | 867  | 875  | 883  | 892  | 900  | 908  | 917  | 925  |
| 524 | 933   | 941  | 950  | 958  | 966  | 975  | 983  | 991  | 999  | *008 |
| 525 | 72016 | 024  | 032  | 041  | 049  | 057  | 066  | 074  | 082  | 090  |
| 526 | 099   | 107  | 115  | 123  | 132  | 140  | 148  | 156  | 165  | 173  |
| 527 | 181   | 189  | 198  | 206  | 214  | 222  | 230  | 239  | 247  | 255  |
| 528 | 263   | 272  | 280  | 288  | 296  | 304  | 313  | 321  | 329  | 337  |
| 529 | 346   | 354  | 362  | 370  | 378  | 387  | 395  | 403  | 411  | 419  |
| 530 | 428   | 436  | 444  | 452  | 460  | 469  | 477  | 485  | 493  | 501  |
| 531 | 509   | 518  | 526  | 534  | 542  | 550  | 558  | 567  | 575  | 583  |
| 532 | 591   | 599  | 607  | 616  | 624  | 632  | 640  | 648  | 656  | 665  |
| 533 | 673   | 681  | 689  | 697  | 705  | 713  | 722  | 730  | 738  | 746  |
| 534 | 754   | 762  | 770  | 779  | 787  | 795  | 803  | 811  | 819  | 827  |
| 535 | 835   | 843  | 852  | 860  | 868  | 876  | 884  | 892  | 900  | 908  |
| 536 | 916   | 925  | 933  | 941  | 949  | 957  | 965  | 973  | 981  | 989  |
| 537 | 997   | *006 | *014 | *022 | *030 | *038 | *046 | *054 | *062 | *070 |
| 538 | 73078 | 086  | 094  | 102  | 111  | 119  | 127  | 135  | 143  | 151  |
| 539 | 159   | 167  | 175  | 183  | 191  | 199  | 207  | 215  | 223  | 231  |

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|-----|-------|-----|-----|-----|------|------|------|------|------|------|
| 540 | 73239 | 247 | 255 | 263 | 272  | 280  | 288  | 296  | 304  | 312  |
| 541 | 320   | 328 | 336 | 344 | 352  | 360  | 368  | 376  | 384  | 392  |
| 542 | 400   | 408 | 416 | 424 | 432  | 440  | 448  | 456  | 464  | 472  |
| 543 | 480   | 488 | 496 | 504 | 512  | 520  | 528  | 536  | 544  | 552  |
| 544 | 560   | 568 | 576 | 584 | 592  | 600  | 608  | 616  | 624  | 632  |
| 545 | 640   | 648 | 656 | 664 | 672  | 679  | 687  | 695  | 703  | 711  |
| 546 | 719   | 727 | 735 | 743 | 751  | 759  | 767  | 775  | 783  | 791  |
| 547 | 799   | 807 | 815 | 823 | 830  | 838  | 846  | 854  | 862  | 870  |
| 548 | 878   | 886 | 894 | 902 | 910  | 918  | 926  | 933  | 941  | 949  |
| 549 | 957   | 965 | 973 | 981 | 989  | 997  | *005 | *013 | *020 | *028 |
| 550 | 74036 | 044 | 052 | 060 | 068  | 076  | 084  | 092  | 099  | 107  |
| 551 | 115   | 123 | 131 | 139 | 147  | 155  | 162  | 170  | 178  | 186  |
| 552 | 194   | 202 | 210 | 218 | 225  | 233  | 241  | 249  | 257  | 265  |
| 553 | 273   | 280 | 288 | 296 | 304  | 312  | 320  | 327  | 335  | 343  |
| 554 | 351   | 359 | 367 | 374 | 382  | 390  | 398  | 406  | 414  | 421  |
| 555 | 429   | 437 | 445 | 453 | 461  | 468  | 476  | 484  | 492  | 500  |
| 556 | 507   | 515 | 523 | 531 | 539  | 547  | 554  | 562  | 570  | 578  |
| 557 | 586   | 593 | 601 | 609 | 617  | 624  | 632  | 640  | 648  | 656  |
| 558 | 663   | 671 | 679 | 687 | 695  | 702  | 710  | 718  | 726  | 733  |
| 559 | 741   | 749 | 757 | 764 | 772  | 780  | 788  | 796  | 803  | 811  |
| 560 | 819   | 827 | 834 | 842 | 850  | 858  | 865  | 873  | 881  | 889  |
| 561 | 896   | 904 | 912 | 920 | 927  | 935  | 943  | 950  | 958  | 966  |
| 562 | 974   | 981 | 989 | 997 | *005 | *012 | *020 | *028 | *035 | *043 |
| 563 | 75051 | 059 | 066 | 074 | 082  | 089  | 097  | 105  | 113  | 120  |
| 564 | 128   | 136 | 143 | 151 | 159  | 166  | 174  | 182  | 189  | 197  |
| 565 | 205   | 213 | 220 | 228 | 236  | 243  | 251  | 259  | 266  | 274  |
| 566 | 282   | 289 | 297 | 305 | 312  | 320  | 328  | 335  | 343  | 351  |
| 567 | 358   | 366 | 374 | 381 | 389  | 397  | 404  | 412  | 420  | 427  |
| 568 | 435   | 442 | 450 | 458 | 465  | 473  | 481  | 488  | 496  | 504  |
| 569 | 511   | 519 | 526 | 534 | 542  | 549  | 557  | 565  | 572  | 580  |
| 570 | 587   | 595 | 603 | 610 | 618  | 626  | 633  | 641  | 648  | 656  |
| 571 | 664   | 671 | 679 | 686 | 694  | 702  | 709  | 717  | 724  | 732  |
| 572 | 740   | 747 | 755 | 762 | 770  | 778  | 785  | 793  | 800  | 808  |
| 573 | 815   | 823 | 831 | 838 | 846  | 853  | 861  | 868  | 876  | 884  |
| 574 | 891   | 899 | 906 | 914 | 921  | 929  | 937  | 944  | 952  | 959  |
| 575 | 967   | 974 | 982 | 989 | 997  | *005 | *012 | *020 | *027 | *035 |
| 576 | 76042 | 050 | 057 | 065 | 072  | 080  | 087  | 095  | 103  | 110  |
| 577 | 118   | 125 | 133 | 140 | 148  | 155  | 163  | 170  | 178  | 185  |
| 578 | 193   | 200 | 208 | 215 | 223  | 230  | 238  | 245  | 253  | 260  |
| 579 | 268   | 275 | 283 | 290 | 298  | 305  | 313  | 320  | 328  | 335  |

|     | 0     | 1   | 2   | 3   | 4   | 5   | 6    | 7    | 8    | 9    |
|-----|-------|-----|-----|-----|-----|-----|------|------|------|------|
| 580 | 76343 | 350 | 358 | 365 | 373 | 380 | 388  | 395  | 403  | 410  |
| 581 | 418   | 425 | 433 | 440 | 448 | 455 | 462  | 470  | 477  | 485  |
| 582 | 492   | 500 | 507 | 515 | 522 | 530 | 537  | 545  | 552  | 559  |
| 583 | 567   | 574 | 582 | 589 | 597 | 604 | 612  | 619  | 626  | 634  |
| 584 | 641   | 649 | 656 | 664 | 671 | 678 | 686  | 693  | 701  | 708  |
| 585 | 716   | 723 | 730 | 738 | 745 | 753 | 760  | 768  | 775  | 782  |
| 586 | 790   | 797 | 805 | 812 | 819 | 827 | 834  | 842  | 849  | 856  |
| 587 | 864   | 871 | 879 | 886 | 893 | 901 | 908  | 916  | 923  | 930  |
| 588 | 938   | 945 | 953 | 960 | 967 | 975 | 982  | 989  | 997  | *004 |
| 589 | 77012 | 019 | 026 | 034 | 041 | 048 | 056  | 063  | 070  | 078  |
| 590 | 085   | 093 | 100 | 107 | 115 | 122 | 129  | 137  | 144  | 151  |
| 591 | 159   | 166 | 173 | 181 | 188 | 195 | 203  | 210  | 217  | 225  |
| 592 | 232   | 240 | 247 | 254 | 262 | 269 | 276  | 283  | 291  | 298  |
| 593 | 305   | 313 | 320 | 327 | 335 | 342 | 349  | 357  | 364  | 371  |
| 594 | 379   | 386 | 393 | 401 | 408 | 415 | 422  | 430  | 437  | 444  |
| 595 | 452   | 459 | 466 | 474 | 481 | 488 | 495  | 503  | 510  | 517  |
| 596 | 525   | 532 | 539 | 546 | 554 | 561 | 568  | 576  | 583  | 590  |
| 597 | 597   | 605 | 612 | 619 | 627 | 634 | 641  | 648  | 656  | 663  |
| 598 | 670   | 677 | 685 | 692 | 699 | 706 | 714  | 721  | 728  | 735  |
| 599 | 743   | 750 | 757 | 764 | 772 | 779 | 786  | 793  | 801  | 808  |
| 600 | 815   | 822 | 830 | 837 | 844 | 851 | 859  | 866  | 873  | 880  |
| 601 | 887   | 895 | 902 | 909 | 916 | 924 | 931  | 938  | 945  | 952  |
| 602 | 960   | 967 | 974 | 981 | 988 | 996 | *003 | *010 | *017 | *025 |
| 603 | 78032 | 039 | 046 | 053 | 061 | 068 | 075  | 082  | 089  | 097  |
| 604 | 104   | 111 | 118 | 125 | 132 | 140 | 147  | 154  | 161  | 168  |
| 605 | 176   | 183 | 190 | 197 | 204 | 211 | 219  | 226  | 233  | 240  |
| 606 | 247   | 254 | 262 | 269 | 276 | 283 | 290  | 297  | 305  | 312  |
| 607 | 319   | 326 | 333 | 340 | 347 | 355 | 362  | 369  | 376  | 383  |
| 608 | 390   | 398 | 405 | 412 | 419 | 426 | 433  | 440  | 447  | 455  |
| 609 | 462   | 469 | 476 | 483 | 490 | 497 | 504  | 512  | 519  | 526  |
| 610 | 533   | 540 | 547 | 554 | 561 | 569 | 576  | 583  | 590  | 597  |
| 611 | 604   | 611 | 618 | 625 | 633 | 640 | 647  | 654  | 661  | 668  |
| 612 | 675   | 682 | 689 | 696 | 704 | 711 | 718  | 725  | 732  | 739  |
| 613 | 746   | 753 | 760 | 767 | 774 | 781 | 789  | 796  | 803  | 810  |
| 614 | 817   | 824 | 831 | 838 | 845 | 852 | 859  | 866  | 873  | 880  |
| 615 | 888   | 895 | 902 | 909 | 916 | 923 | 930  | 937  | 944  | 951  |
| 616 | 958   | 965 | 972 | 979 | 986 | 993 | *000 | *007 | *014 | *021 |
| 617 | 79029 | 036 | 043 | 050 | 057 | 064 | 071  | 078  | 085  | 092  |
| 618 | 099   | 106 | 113 | 120 | 127 | 134 | 141  | 148  | 155  | 162  |
| 619 | 169   | 176 | 183 | 190 | 197 | 204 | 211  | 218  | 225  | 232  |



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|-----|-------|-----|-----|-----|-----|-----|-----|------|------|------|
| 620 | 79239 | 246 | 253 | 260 | 267 | 274 | 281 | 288  | 295  | 302  |
| 621 | 309   | 316 | 323 | 330 | 337 | 344 | 351 | 358  | 365  | 372  |
| 622 | 379   | 386 | 393 | 400 | 407 | 414 | 421 | 428  | 435  | 442  |
| 623 | 449   | 456 | 463 | 470 | 477 | 484 | 491 | 498  | 505  | 511  |
| 624 | 518   | 525 | 532 | 539 | 546 | 553 | 560 | 567  | 574  | 581  |
| 625 | 588   | 595 | 602 | 609 | 616 | 623 | 630 | 637  | 644  | 650  |
| 626 | 657   | 664 | 671 | 678 | 685 | 692 | 699 | 706  | 713  | 720  |
| 627 | 727   | 734 | 741 | 748 | 754 | 761 | 768 | 775  | 782  | 789  |
| 628 | 796   | 803 | 810 | 817 | 824 | 831 | 837 | 844  | 851  | 858  |
| 629 | 865   | 872 | 879 | 886 | 893 | 900 | 906 | 913  | 920  | 927  |
| 630 | 934   | 941 | 948 | 955 | 962 | 969 | 975 | 982  | 989  | 996  |
| 631 | 80003 | 010 | 017 | 024 | 030 | 037 | 044 | 051  | 058  | 065  |
| 632 | 072   | 079 | 085 | 092 | 099 | 106 | 113 | 120  | 127  | 134  |
| 633 | 140   | 147 | 154 | 161 | 168 | 175 | 182 | 188  | 195  | 202  |
| 634 | 209   | 216 | 223 | 229 | 236 | 243 | 250 | 257  | 264  | 271  |
| 635 | 277   | 284 | 291 | 298 | 305 | 312 | 318 | 325  | 332  | 339  |
| 636 | 346   | 353 | 359 | 366 | 373 | 380 | 387 | 393  | 400  | 407  |
| 637 | 414   | 421 | 428 | 434 | 441 | 448 | 455 | 462  | 468  | 475  |
| 638 | 482   | 489 | 496 | 502 | 509 | 516 | 523 | 530  | 536  | 543  |
| 639 | 550   | 557 | 564 | 570 | 577 | 584 | 591 | 598  | 604  | 611  |
| 640 | 618   | 625 | 632 | 638 | 645 | 652 | 659 | 665  | 672  | 679  |
| 641 | 686   | 693 | 699 | 706 | 713 | 720 | 726 | 733  | 740  | 747  |
| 642 | 754   | 760 | 767 | 774 | 781 | 787 | 794 | 801  | 808  | 814  |
| 643 | 821   | 828 | 835 | 841 | 848 | 855 | 862 | 868  | 875  | 882  |
| 644 | 889   | 895 | 902 | 909 | 916 | 922 | 929 | 936  | 943  | 949  |
| 645 | 956   | 963 | 969 | 976 | 983 | 990 | 996 | *003 | *010 | *017 |
| 646 | 81023 | 030 | 037 | 043 | 050 | 057 | 064 | 070  | 077  | 084  |
| 647 | 090   | 097 | 104 | 111 | 117 | 124 | 131 | 137  | 144  | 151  |
| 648 | 158   | 164 | 171 | 178 | 184 | 191 | 198 | 204  | 211  | 218  |
| 649 | 224   | 231 | 238 | 245 | 251 | 258 | 265 | 271  | 278  | 285  |
| 650 | 291   | 298 | 305 | 311 | 318 | 325 | 331 | 338  | 345  | 351  |
| 651 | 358   | 365 | 371 | 378 | 385 | 391 | 398 | 405  | 411  | 418  |
| 652 | 425   | 431 | 438 | 445 | 451 | 458 | 465 | 471  | 478  | 485  |
| 653 | 491   | 498 | 505 | 511 | 518 | 525 | 531 | 538  | 544  | 551  |
| 654 | 558   | 564 | 571 | 578 | 584 | 591 | 598 | 604  | 611  | 617  |
| 655 | 624   | 631 | 637 | 644 | 651 | 657 | 664 | 671  | 677  | 684  |
| 656 | 690   | 697 | 704 | 710 | 717 | 723 | 730 | 737  | 743  | 750  |
| 657 | 757   | 763 | 770 | 776 | 783 | 790 | 796 | 803  | 809  | 816  |
| 658 | 823   | 829 | 836 | 842 | 849 | 856 | 862 | 869  | 875  | 882  |
| 659 | 889   | 895 | 902 | 908 | 915 | 921 | 928 | 935  | 941  | 948  |



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|-----|-------|------|------|------|------|------|------|------|------|------|
| 660 | 81954 | 961  | 968  | 974  | 981  | 987  | 994  | *00  | 403  | 410  |
| 661 | 82020 | 027  | 033  | 040  | 046  | 053  | 060  | 066  | 477  | 485  |
| 662 | 086   | 092  | 099  | 105  | 112  | 119  | 125  | 131  | 552  | 559  |
| 663 | 151   | 158  | 164  | 171  | 178  | 184  | 191  | 197  | 203  | 634  |
| 664 | 217   | 223  | 230  | 236  | 243  | 249  | 256  | 263  | 269  | 708  |
| 665 | 282   | 289  | 295  | 302  | 308  | 315  | 321  | 328  | 775  | 782  |
| 666 | 347   | 354  | 360  | 367  | 373  | 380  | 387  | 393  | 849  | 856  |
| 667 | 413   | 419  | 426  | 432  | 439  | 445  | 452  | 458  | 923  | 930  |
| 668 | 478   | 484  | 491  | 497  | 504  | 510  | 517  | 524  | 997  | *004 |
| 669 | 543   | 549  | 556  | 562  | 569  | 575  | 582  | 588  | 070  | 078  |
| 670 | 607   | 614  | 620  | 627  | 633  | 640  | 646  | 653  | 144  | 151  |
| 671 | 672   | 679  | 685  | 692  | 698  | 705  | 711  | 718  | 217  | 225  |
| 672 | 737   | 743  | 750  | 756  | 763  | 769  | 776  | 783  | 291  | 298  |
| 673 | 802   | 808  | 814  | 821  | 827  | 834  | 840  | 847  | 364  | 371  |
| 674 | 866   | 872  | 879  | 885  | 892  | 898  | 905  | 911  | 437  | 444  |
| 675 | 930   | 937  | 943  | 950  | 956  | 963  | 969  | 975  | 982  | 988  |
| 676 | 995   | *001 | *008 | *014 | *020 | *027 | *033 | *040 | *046 | *052 |
| 677 | 83059 | 065  | 072  | 078  | 085  | 091  | 097  | 104  | 110  | 117  |
| 678 | 123   | 129  | 136  | 142  | 149  | 155  | 161  | 168  | 174  | 181  |
| 679 | 187   | 193  | 200  | 206  | 213  | 219  | 225  | 232  | 238  | 245  |
| 680 | 251   | 257  | 264  | 270  | 276  | 283  | 289  | 296  | 302  | 308  |
| 681 | 315   | 321  | 327  | 334  | 340  | 347  | 353  | 359  | 366  | 372  |
| 682 | 378   | 385  | 391  | 398  | 404  | 410  | 417  | 423  | 429  | 436  |
| 683 | 442   | 448  | 455  | 461  | 467  | 474  | 480  | 487  | 493  | 499  |
| 684 | 506   | 512  | 518  | 525  | 531  | 537  | 544  | 550  | 556  | 563  |
| 685 | 569   | 575  | 582  | 588  | 594  | 601  | 607  | 613  | 620  | 626  |
| 686 | 632   | 639  | 645  | 651  | 658  | 664  | 670  | 677  | 683  | 689  |
| 687 | 696   | 702  | 708  | 715  | 721  | 727  | 734  | 740  | 746  | 753  |
| 688 | 759   | 765  | 771  | 778  | 784  | 790  | 797  | 803  | 809  | 816  |
| 689 | 822   | 828  | 835  | 841  | 847  | 853  | 860  | 866  | 872  | 879  |
| 690 | 885   | 891  | 897  | 904  | 910  | 916  | 923  | 929  | 935  | 942  |
| 691 | 948   | 954  | 960  | 967  | 973  | 979  | 985  | 992  | 998  | *004 |
| 692 | 84011 | 017  | 023  | 029  | 036  | 042  | 048  | 055  | 061  | 067  |
| 693 | 073   | 080  | 086  | 092  | 098  | 105  | 111  | 117  | 123  | 130  |
| 694 | 136   | 142  | 148  | 155  | 161  | 167  | 173  | 180  | 186  | 192  |
| 695 | 198   | 205  | 211  | 217  | 223  | 230  | 236  | 242  | 248  | 255  |
| 696 | 261   | 267  | 273  | 280  | 286  | 292  | 298  | 305  | 311  | 317  |
| 697 | 323   | 330  | 336  | 342  | 348  | 354  | 361  | 367  | 373  | 379  |
| 698 | 386   | 392  | 398  | 404  | 410  | 417  | 423  | 429  | 435  | 442  |
| 699 | 448   | 454  | 460  | 466  | 473  | 479  | 485  | 491  | 497  | 504  |

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|-----|-------|-----|-----|-----|-----|------|------|------|------|------|
| 620 | 79239 | 16  | 522 | 528 | 535 | 541  | 547  | 553  | 559  | 566  |
| 621 | 792   | 78  | 584 | 590 | 597 | 603  | 609  | 615  | 621  | 628  |
| 622 | 793   | 40  | 646 | 652 | 658 | 665  | 671  | 677  | 683  | 689  |
| 623 | 794   | 02  | 702 | 708 | 714 | 720  | 726  | 733  | 739  | 745  |
| 624 | 795   | 63  | 770 | 776 | 782 | 788  | 794  | 800  | 807  | 813  |
| 625 | 58    | 325 | 831 | 837 | 844 | 850  | 856  | 862  | 868  | 874  |
| 626 | 65    | 387 | 893 | 899 | 905 | 911  | 917  | 924  | 930  | 936  |
| 627 | 72    | 948 | 954 | 960 | 967 | 973  | 979  | 985  | 991  | 997  |
| 628 | 796   | 009 | 016 | 022 | 028 | 034  | 040  | 046  | 052  | 058  |
| 629 | 865   | 71  | 077 | 083 | 089 | 095  | 101  | 107  | 114  | 120  |
| 630 | 934   | 22  | 138 | 144 | 150 | 156  | 163  | 169  | 175  | 181  |
| 631 | 80003 | 493 | 199 | 205 | 211 | 217  | 224  | 230  | 236  | 242  |
| 632 | 072   | 254 | 260 | 266 | 272 | 278  | 285  | 291  | 297  | 303  |
| 633 | 146   | 315 | 321 | 327 | 333 | 339  | 345  | 352  | 358  | 364  |
| 634 | 20    | 376 | 382 | 388 | 394 | 400  | 406  | 412  | 418  | 425  |
| 716 | 431   | 437 | 443 | 449 | 455 | 461  | 467  | 473  | 479  | 485  |
| 717 | 491   | 497 | 503 | 509 | 516 | 522  | 528  | 534  | 540  | 546  |
| 718 | 552   | 558 | 564 | 570 | 576 | 582  | 588  | 594  | 600  | 606  |
| 719 | 612   | 618 | 625 | 631 | 637 | 643  | 649  | 655  | 661  | 667  |
| 720 | 673   | 679 | 685 | 691 | 697 | 703  | 709  | 715  | 721  | 727  |
| 721 | 733   | 739 | 745 | 751 | 757 | 763  | 769  | 775  | 781  | 788  |
| 722 | 794   | 800 | 806 | 812 | 818 | 824  | 830  | 836  | 842  | 848  |
| 723 | 854   | 860 | 866 | 872 | 878 | 884  | 890  | 896  | 902  | 908  |
| 724 | 914   | 920 | 926 | 932 | 938 | 944  | 950  | 956  | 962  | 968  |
| 725 | 974   | 980 | 986 | 992 | 998 | *004 | *010 | *016 | *022 | *028 |
| 726 | 86034 | 040 | 046 | 052 | 058 | 064  | 070  | 076  | 082  | 088  |
| 727 | 094   | 100 | 106 | 112 | 118 | 124  | 130  | 136  | 141  | 147  |
| 728 | 153   | 159 | 165 | 171 | 177 | 183  | 189  | 195  | 201  | 207  |
| 729 | 213   | 219 | 225 | 231 | 237 | 243  | 249  | 255  | 261  | 267  |
| 730 | 273   | 279 | 285 | 291 | 297 | 303  | 308  | 314  | 320  | 326  |
| 731 | 332   | 338 | 344 | 350 | 356 | 362  | 368  | 374  | 380  | 386  |
| 732 | 392   | 398 | 404 | 410 | 415 | 421  | 427  | 433  | 439  | 445  |
| 733 | 451   | 457 | 463 | 469 | 475 | 481  | 487  | 493  | 499  | 504  |
| 734 | 510   | 516 | 522 | 528 | 534 | 540  | 546  | 552  | 558  | 564  |
| 735 | 570   | 576 | 581 | 587 | 593 | 599  | 605  | 611  | 617  | 623  |
| 736 | 629   | 635 | 641 | 646 | 652 | 658  | 664  | 670  | 676  | 682  |
| 737 | 688   | 694 | 700 | 705 | 711 | 717  | 723  | 729  | 735  | 741  |
| 738 | 747   | 753 | 759 | 764 | 770 | 776  | 782  | 788  | 794  | 800  |
| 739 | 806   | 812 | 817 | 823 | 829 | 835  | 841  | 847  | 853  | 859  |
| 740 | 864   | 870 | 876 | 882 | 888 | 894  | 900  | 906  | 911  | 917  |

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|-----|-------|-----|-----|------|------|------|------|------|------|------|
| 740 | 86923 | 929 | 935 | 941  | 947  | 953  | 958  | 964  | 970  | 976  |
| 741 | 982   | 988 | 994 | 999  | *005 | *011 | *017 | *023 | *029 | *035 |
| 742 | 87040 | 046 | 052 | 058  | 064  | 070  | 075  | 081  | 087  | 093  |
| 743 | 099   | 105 | 111 | 116  | 122  | 128  | 134  | 140  | 146  | 151  |
| 744 | 157   | 163 | 169 | 175  | 181  | 186  | 192  | 198  | 204  | 210  |
| 745 | 216   | 221 | 227 | 233  | 239  | 245  | 251  | 256  | 262  | 268  |
| 746 | 274   | 280 | 286 | 291  | 297  | 303  | 309  | 315  | 320  | 326  |
| 747 | 332   | 338 | 344 | 349  | 355  | 361  | 367  | 373  | 379  | 384  |
| 748 | 390   | 396 | 402 | 408  | 413  | 419  | 425  | 431  | 437  | 442  |
| 749 | 448   | 454 | 460 | 466  | 471  | 477  | 483  | 489  | 495  | 500  |
| 750 | 506   | 512 | 518 | 523  | 529  | 535  | 541  | 547  | 552  | 558  |
| 751 | 564   | 570 | 576 | 581  | 587  | 593  | 599  | 604  | 610  | 616  |
| 752 | 622   | 628 | 633 | 639  | 645  | 651  | 656  | 662  | 668  | 674  |
| 753 | 679   | 685 | 691 | 697  | 703  | 708  | 714  | 720  | 726  | 731  |
| 754 | 737   | 743 | 749 | 754  | 760  | 766  | 772  | 777  | 783  | 789  |
| 755 | 795   | 800 | 806 | 812  | 818  | 823  | 829  | 835  | 841  | 846  |
| 756 | 852   | 858 | 864 | 869  | 875  | 881  | 887  | 892  | 898  | 904  |
| 757 | 910   | 915 | 921 | 927  | 933  | 938  | 944  | 950  | 955  | 961  |
| 758 | 967   | 973 | 978 | 984  | 990  | 996  | *001 | *007 | *013 | *018 |
| 759 | 88024 | 030 | 036 | 041  | 047  | 053  | 058  | 064  | 070  | 076  |
| 760 | 081   | 087 | 093 | 098  | 104  | 110  | 116  | 121  | 127  | 133  |
| 761 | 138   | 144 | 150 | 156  | 161  | 167  | 173  | 178  | 184  | 190  |
| 762 | 195   | 201 | 207 | 213  | 218  | 224  | 230  | 235  | 241  | 247  |
| 763 | 252   | 258 | 264 | 270  | 275  | 281  | 287  | 292  | 298  | 304  |
| 764 | 309   | 315 | 321 | 326  | 332  | 338  | 343  | 349  | 355  | 360  |
| 765 | 366   | 372 | 377 | 383  | 389  | 395  | 400  | 406  | 412  | 417  |
| 766 | 423   | 429 | 434 | 440  | 446  | 451  | 457  | 463  | 468  | 474  |
| 767 | 480   | 485 | 491 | 497  | 502  | 508  | 513  | 519  | 525  | 530  |
| 768 | 536   | 542 | 547 | 553  | 559  | 564  | 570  | 576  | 581  | 587  |
| 769 | 593   | 598 | 604 | 610  | 615  | 621  | 627  | 632  | 638  | 643  |
| 770 | 649   | 655 | 660 | 666  | 672  | 677  | 683  | 689  | 694  | 700  |
| 771 | 705   | 711 | 717 | 722  | 728  | 734  | 739  | 745  | 750  | 756  |
| 772 | 762   | 767 | 773 | 779  | 784  | 790  | 795  | 801  | 807  | 812  |
| 773 | 818   | 824 | 829 | 835  | 840  | 846  | 852  | 857  | 863  | 868  |
| 774 | 874   | 880 | 885 | 891  | 897  | 902  | 908  | 913  | 919  | 925  |
| 775 | 930   | 936 | 941 | 947  | 953  | 958  | 964  | 969  | 975  | 981  |
| 776 | 986   | 992 | 997 | *003 | *009 | *014 | *020 | *025 | *031 | *037 |
| 777 | 89042 | 048 | 053 | 059  | 064  | 070  | 076  | 081  | 087  | 092  |
| 778 | 098   | 104 | 109 | 115  | 120  | 126  | 131  | 137  | 143  | 148  |
| 779 | 154   | 159 | 165 | 170  | 176  | 182  | 187  | 193  | 198  | 204  |

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|-----|-------|-----|-----|-----|------|------|------|------|------|------|
| 780 | 89209 | 215 | 221 | 226 | 232  | 237  | 243  | 248  | 254  | 260  |
| 781 | 265   | 271 | 276 | 282 | 287  | 293  | 298  | 304  | 310  | 315  |
| 782 | 321   | 326 | 332 | 337 | 343  | 348  | 354  | 360  | 365  | 371  |
| 783 | 376   | 382 | 387 | 393 | 398  | 404  | 409  | 415  | 421  | 426  |
| 784 | 432   | 437 | 443 | 448 | 454  | 459  | 465  | 470  | 476  | 481  |
| 785 | 487   | 492 | 498 | 504 | 509  | 515  | 520  | 526  | 531  | 537  |
| 786 | 542   | 548 | 553 | 559 | 564  | 570  | 575  | 581  | 586  | 592  |
| 787 | 597   | 603 | 609 | 614 | 620  | 625  | 631  | 636  | 642  | 647  |
| 788 | 653   | 658 | 664 | 669 | 675  | 680  | 686  | 691  | 697  | 702  |
| 789 | 708   | 713 | 719 | 724 | 730  | 735  | 741  | 746  | 752  | 757  |
| 790 | 763   | 768 | 774 | 779 | 785  | 790  | 796  | 801  | 807  | 812  |
| 791 | 818   | 823 | 829 | 834 | 840  | 845  | 851  | 856  | 862  | 867  |
| 792 | 873   | 878 | 883 | 889 | 894  | 900  | 905  | 911  | 916  | 922  |
| 793 | 927   | 933 | 938 | 944 | 949  | 955  | 960  | 966  | 971  | 977  |
| 794 | 982   | 988 | 993 | 998 | *004 | *009 | *015 | *020 | *026 | *031 |
| 795 | 90037 | 042 | 048 | 053 | 059  | 064  | 069  | 075  | 080  | 086  |
| 796 | 091   | 097 | 102 | 108 | 113  | 119  | 124  | 129  | 135  | 140  |
| 797 | 146   | 151 | 157 | 162 | 168  | 173  | 179  | 184  | 189  | 195  |
| 798 | 200   | 206 | 211 | 217 | 222  | 227  | 233  | 238  | 244  | 249  |
| 799 | 255   | 260 | 266 | 271 | 276  | 282  | 287  | 293  | 298  | 304  |
| 800 | 309   | 314 | 320 | 325 | 331  | 336  | 342  | 347  | 352  | 358  |
| 801 | 363   | 369 | 374 | 380 | 385  | 390  | 396  | 401  | 407  | 412  |
| 802 | 417   | 423 | 428 | 434 | 439  | 445  | 450  | 455  | 461  | 466  |
| 803 | 472   | 477 | 482 | 488 | 493  | 499  | 504  | 509  | 515  | 520  |
| 804 | 526   | 531 | 536 | 542 | 547  | 553  | 558  | 563  | 569  | 574  |
| 805 | 580   | 585 | 590 | 596 | 601  | 607  | 612  | 617  | 623  | 628  |
| 806 | 634   | 639 | 644 | 650 | 655  | 660  | 666  | 671  | 677  | 682  |
| 807 | 687   | 693 | 698 | 703 | 709  | 714  | 720  | 725  | 730  | 736  |
| 808 | 741   | 747 | 752 | 757 | 763  | 768  | 773  | 779  | 784  | 789  |
| 809 | 795   | 800 | 806 | 811 | 816  | 822  | 827  | 832  | 838  | 843  |
| 810 | 849   | 854 | 859 | 865 | 870  | 875  | 881  | 886  | 891  | 897  |
| 811 | 902   | 907 | 913 | 918 | 924  | 929  | 934  | 940  | 945  | 950  |
| 812 | 956   | 961 | 966 | 972 | 977  | 982  | 988  | 993  | 998  | *004 |
| 813 | 91009 | 014 | 020 | 025 | 030  | 036  | 041  | 046  | 052  | 057  |
| 814 | 062   | 068 | 073 | 078 | 084  | 089  | 094  | 100  | 105  | 110  |
| 815 | 116   | 121 | 126 | 132 | 137  | 142  | 148  | 153  | 158  | 164  |
| 816 | 169   | 174 | 180 | 185 | 190  | 196  | 201  | 206  | 212  | 217  |
| 817 | 222   | 228 | 233 | 238 | 243  | 249  | 254  | 259  | 265  | 270  |
| 818 | 275   | 281 | 286 | 291 | 297  | 302  | 307  | 312  | 318  | 323  |
| 819 | 328   | 334 | 339 | 344 | 350  | 355  | 360  | 365  | 371  | 376  |



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| 820 | 91381 | 387 | 392  | 397  | 403  | 408  | 413  | 418  | 424  | 429  |
| 821 | 434   | 440 | 445  | 450  | 455  | 461  | 466  | 471  | 477  | 482  |
| 822 | 487   | 492 | 498  | 503  | 508  | 514  | 519  | 524  | 529  | 535  |
| 823 | 540   | 545 | 551  | 556  | 561  | 566  | 572  | 577  | 582  | 587  |
| 824 | 593   | 598 | 603  | 609  | 614  | 619  | 624  | 630  | 635  | 640  |
| 825 | 645   | 651 | 656  | 661  | 666  | 672  | 677  | 682  | 687  | 693  |
| 826 | 698   | 703 | 709  | 714  | 719  | 724  | 730  | 735  | 740  | 745  |
| 827 | 751   | 756 | 761  | 766  | 772  | 777  | 782  | 787  | 793  | 798  |
| 828 | 803   | 808 | 814  | 819  | 824  | 829  | 834  | 840  | 845  | 850  |
| 829 | 855   | 861 | 866  | 871  | 876  | 882  | 887  | 892  | 897  | 903  |
| 830 | 908   | 913 | 918  | 924  | 929  | 934  | 939  | 944  | 950  | 955  |
| 831 | 960   | 965 | 971  | 976  | 981  | 986  | 991  | 997  | *002 | *007 |
| 832 | 92012 | 018 | 023  | 028  | 033  | 038  | 044  | 049  | 054  | 059  |
| 833 | 065   | 070 | 075  | 080  | 085  | 091  | 096  | 101  | 106  | 111  |
| 834 | 117   | 122 | 127  | 132  | 137  | 143  | 148  | 153  | 158  | 163  |
| 835 | 169   | 174 | 179  | 184  | 189  | 195  | 200  | 205  | 210  | 215  |
| 836 | 221   | 226 | 231  | 236  | 241  | 247  | 252  | 257  | 262  | 267  |
| 837 | 273   | 278 | 283  | 288  | 293  | 298  | 304  | 309  | 314  | 319  |
| 838 | 324   | 330 | 335  | 340  | 345  | 350  | 355  | 361  | 366  | 371  |
| 839 | 376   | 381 | 387  | 392  | 397  | 402  | 407  | 412  | 418  | 423  |
| 840 | 428   | 433 | 438  | 443  | 449  | 454  | 459  | 464  | 469  | 474  |
| 841 | 480   | 485 | 490  | 495  | 500  | 505  | 511  | 516  | 521  | 526  |
| 842 | 531   | 536 | 542  | 547  | 552  | 557  | 562  | 567  | 572  | 578  |
| 843 | 583   | 588 | 593  | 598  | 603  | 609  | 614  | 619  | 624  | 629  |
| 844 | 634   | 639 | 645  | 650  | 655  | 660  | 665  | 670  | 675  | 681  |
| 845 | 686   | 691 | 696  | 701  | 706  | 711  | 716  | 722  | 727  | 732  |
| 846 | 737   | 742 | 747  | 752  | 758  | 763  | 768  | 773  | 778  | 783  |
| 847 | 788   | 793 | 799  | 804  | 809  | 814  | 819  | 824  | 829  | 834  |
| 848 | 840   | 845 | 850  | 855  | 860  | 865  | 870  | 875  | 881  | 886  |
| 849 | 891   | 896 | 901  | 906  | 911  | 916  | 921  | 927  | 932  | 937  |
| 850 | 942   | 947 | 952  | 957  | 962  | 967  | 973  | 978  | 983  | 988  |
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| 852 | 93044 | 049 | 054  | 059  | 064  | 069  | 075  | 080  | 085  | 090  |
| 853 | 095   | 100 | 105  | 110  | 115  | 120  | 125  | 131  | 136  | 141  |
| 854 | 146   | 151 | 156  | 161  | 166  | 171  | 176  | 181  | 186  | 192  |
| 855 | 197   | 202 | 207  | 212  | 217  | 222  | 227  | 232  | 237  | 242  |
| 856 | 247   | 252 | 258  | 263  | 268  | 273  | 278  | 283  | 288  | 293  |
| 857 | 298   | 303 | 308  | 313  | 318  | 323  | 328  | 334  | 339  | 344  |
| 858 | 349   | 354 | 359  | 364  | 369  | 374  | 379  | 384  | 389  | 394  |
| 859 | 399   | 404 | 409  | 414  | 420  | 425  | 430  | 435  | 440  | 445  |



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|-----|-------|-----|-----|------|------|------|------|------|------|------|
| 860 | 93450 | 455 | 460 | 465  | 470  | 475  | 480  | 485  | 490  | 495  |
| 861 | 500   | 505 | 510 | 515  | 520  | 526  | 531  | 536  | 541  | 546  |
| 862 | 551   | 556 | 561 | 566  | 571  | 576  | 581  | 586  | 591  | 596  |
| 863 | 601   | 606 | 611 | 616  | 621  | 626  | 631  | 636  | 641  | 646  |
| 864 | 651   | 656 | 661 | 666  | 671  | 676  | 682  | 687  | 692  | 697  |
| 865 | 702   | 707 | 712 | 717  | 722  | 727  | 732  | 737  | 742  | 747  |
| 866 | 752   | 757 | 762 | 767  | 772  | 777  | 782  | 787  | 792  | 797  |
| 867 | 802   | 807 | 812 | 817  | 822  | 827  | 832  | 837  | 842  | 847  |
| 868 | 852   | 857 | 862 | 867  | 872  | 877  | 882  | 887  | 892  | 897  |
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| 871 | 94002 | 007 | 012 | 017  | 022  | 027  | 032  | 037  | 042  | 047  |
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| 873 | 101   | 106 | 111 | 116  | 121  | 126  | 131  | 136  | 141  | 146  |
| 874 | 151   | 156 | 161 | 166  | 171  | 176  | 181  | 186  | 191  | 196  |
| 875 | 201   | 206 | 211 | 216  | 221  | 226  | 231  | 236  | 240  | 245  |
| 876 | 250   | 255 | 260 | 265  | 270  | 275  | 280  | 285  | 290  | 295  |
| 877 | 300   | 305 | 310 | 315  | 320  | 325  | 330  | 335  | 340  | 345  |
| 878 | 349   | 354 | 359 | 364  | 369  | 374  | 379  | 384  | 389  | 394  |
| 879 | 399   | 404 | 409 | 414  | 419  | 424  | 429  | 433  | 438  | 443  |
| 880 | 448   | 453 | 458 | 463  | 468  | 473  | 478  | 483  | 488  | 493  |
| 881 | 498   | 503 | 507 | 512  | 517  | 522  | 527  | 532  | 537  | 542  |
| 882 | 547   | 552 | 557 | 562  | 567  | 571  | 576  | 581  | 586  | 591  |
| 883 | 596   | 601 | 606 | 611  | 616  | 721  | 626  | 630  | 635  | 640  |
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| 885 | 694   | 699 | 704 | 709  | 714  | 719  | 724  | 729  | 734  | 738  |
| 886 | 743   | 748 | 753 | 758  | 763  | 768  | 773  | 778  | 783  | 787  |
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| 888 | 841   | 846 | 851 | 856  | 861  | 866  | 871  | 876  | 880  | 885  |
| 889 | 890   | 895 | 900 | 905  | 910  | 915  | 919  | 924  | 929  | 934  |
| 890 | 939   | 944 | 949 | 954  | 959  | 963  | 968  | 973  | 978  | 983  |
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| 893 | 085   | 090 | 095 | 100  | 105  | 109  | 114  | 119  | 124  | 129  |
| 894 | 134   | 139 | 143 | 148  | 153  | 158  | 163  | 168  | 173  | 177  |
| 895 | 182   | 187 | 192 | 197  | 202  | 207  | 211  | 216  | 221  | 226  |
| 896 | 231   | 236 | 240 | 245  | 250  | 255  | 260  | 265  | 270  | 274  |
| 897 | 279   | 284 | 289 | 294  | 299  | 303  | 308  | 313  | 318  | 423  |
| 898 | 328   | 332 | 337 | 342  | 347  | 352  | 357  | 361  | 366  | 371  |
| 899 | 376   | 381 | 386 | 390  | 395  | 400  | 405  | 410  | 415  | 419  |

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|-----|-------|------|------|------|------|------|------|------|------|------|
| 900 | 95424 | 429  | 434  | 439  | 444  | 448  | 453  | 458  | 463  | 468  |
| 901 | 472   | 477  | 482  | 487  | 492  | 497  | 501  | 506  | 511  | 516  |
| 902 | 521   | 525  | 530  | 535  | 540  | 545  | 550  | 554  | 559  | 564  |
| 903 | 569   | 574  | 578  | 583  | 588  | 593  | 598  | 602  | 607  | 612  |
| 904 | 617   | 622  | 626  | 631  | 636  | 641  | 646  | 650  | 655  | 660  |
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| 906 | 713   | 718  | 722  | 727  | 732  | 737  | 742  | 746  | 751  | 756  |
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| 913 | 96047 | 052  | 057  | 061  | 066  | 071  | 076  | 080  | 085  | 090  |
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| 915 | 142   | 147  | 152  | 156  | 161  | 166  | 171  | 175  | 180  | 185  |
| 916 | 190   | 194  | 199  | 204  | 209  | 213  | 218  | 223  | 227  | 232  |
| 917 | 237   | 242  | 246  | 251  | 256  | 261  | 265  | 270  | 275  | 280  |
| 918 | 284   | 289  | 294  | 298  | 303  | 308  | 313  | 317  | 322  | 327  |
| 919 | 332   | 336  | 341  | 346  | 350  | 355  | 360  | 365  | 369  | 374  |
| 920 | 379   | 384  | 388  | 393  | 398  | 402  | 407  | 412  | 417  | 421  |
| 921 | 426   | 431  | 435  | 440  | 445  | 450  | 454  | 459  | 464  | 468  |
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| 923 | 520   | 525  | 530  | 534  | 539  | 544  | 548  | 553  | 558  | 562  |
| 924 | 567   | 572  | 577  | 581  | 586  | 591  | 595  | 600  | 605  | 609  |
| 925 | 614   | 619  | 624  | 628  | 633  | 638  | 642  | 647  | 652  | 656  |
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| 927 | 708   | 713  | 717  | 722  | 727  | 731  | 736  | 741  | 745  | 750  |
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| 929 | 802   | 806  | 811  | 816  | 820  | 825  | 830  | 834  | 839  | 844  |
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| 932 | 942   | 946  | 951  | 956  | 960  | 965  | 970  | 974  | 979  | 984  |
| 933 | 988   | 993  | 997  | *002 | *007 | *011 | *016 | *021 | *025 | *030 |
| 934 | 97035 | 039  | 044  | 049  | 053  | 058  | 063  | 067  | 072  | 077  |
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| 936 | 128   | 132  | 137  | 142  | 146  | 151  | 155  | 160  | 165  | 169  |
| 937 | 174   | 179  | 183  | 188  | 192  | 197  | 202  | 206  | 211  | 216  |
| 938 | 220   | 225  | 230  | 234  | 239  | 243  | 248  | 253  | 257  | 262  |
| 939 | 267   | 271  | 276  | 280  | 285  | 290  | 294  | 299  | 304  | 308  |

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|-----|-------|-----|-----|------|------|------|------|------|------|------|
| 940 | 97313 | 317 | 322 | 327  | 331  | 336  | 340  | 345  | 350  | 354  |
| 941 | 359   | 364 | 368 | 373  | 377  | 382  | 387  | 391  | 396  | 400  |
| 942 | 405   | 410 | 414 | 419  | 424  | 428  | 433  | 437  | 442  | 447  |
| 943 | 451   | 456 | 460 | 465  | 470  | 474  | 479  | 483  | 488  | 493  |
| 944 | 497   | 502 | 506 | 511  | 516  | 520  | 525  | 529  | 534  | 539  |
| 945 | 543   | 548 | 552 | 557  | 562  | 566  | 571  | 575  | 580  | 585  |
| 946 | 589   | 594 | 598 | 603  | 607  | 612  | 617  | 621  | 626  | 630  |
| 947 | 635   | 640 | 644 | 649  | 653  | 658  | 663  | 667  | 672  | 676  |
| 948 | 681   | 685 | 690 | 695  | 699  | 704  | 708  | 713  | 717  | 722  |
| 949 | 727   | 731 | 736 | 740  | 745  | 749  | 754  | 759  | 763  | 768  |
| 950 | 772   | 777 | 782 | 786  | 791  | 795  | 800  | 804  | 809  | 813  |
| 951 | 818   | 823 | 827 | 832  | 836  | 841  | 845  | 850  | 855  | 859  |
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| 953 | 909   | 914 | 918 | 923  | 928  | 932  | 937  | 941  | 946  | 950  |
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| 955 | 98000 | 005 | 009 | 014  | 019  | 023  | 028  | 032  | 037  | 041  |
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| 957 | 091   | 096 | 100 | 105  | 109  | 114  | 118  | 123  | 127  | 132  |
| 958 | 137   | 141 | 146 | 150  | 155  | 159  | 164  | 168  | 173  | 177  |
| 959 | 182   | 186 | 191 | 195  | 200  | 204  | 209  | 214  | 218  | 223  |
| 960 | 227   | 232 | 236 | 241  | 245  | 250  | 254  | 259  | 263  | 268  |
| 961 | 272   | 277 | 281 | 286  | 290  | 295  | 299  | 304  | 308  | 313  |
| 962 | 318   | 322 | 327 | 331  | 336  | 340  | 345  | 349  | 354  | 358  |
| 963 | 363   | 367 | 372 | 376  | 381  | 385  | 390  | 394  | 399  | 403  |
| 964 | 408   | 412 | 417 | 421  | 426  | 430  | 435  | 439  | 444  | 448  |
| 965 | 453   | 457 | 462 | 466  | 471  | 475  | 480  | 484  | 489  | 493  |
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| 971 | 722   | 726 | 731 | 735  | 740  | 744  | 749  | 753  | 758  | 762  |
| 972 | 767   | 771 | 776 | 780  | 784  | 789  | 793  | 798  | 802  | 807  |
| 973 | 811   | 816 | 820 | 825  | 829  | 834  | 838  | 843  | 847  | 851  |
| 974 | 856   | 860 | 865 | 869  | 874  | 878  | 883  | 887  | 892  | 896  |
| 975 | 900   | 905 | 909 | 914  | 918  | 923  | 927  | 932  | 936  | 941  |
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| 977 | 989   | 994 | 998 | *003 | *007 | *012 | *016 | *021 | *025 | *029 |
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| 979 | 078   | 083 | 087 | 092  | 096  | 100  | 105  | 109  | 114  | 118  |

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|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 980 | 99123 | 127 | 131 | 136 | 140 | 145 | 149 | 154 | 158 | 162 |
| 981 | 167   | 171 | 176 | 180 | 185 | 189 | 193 | 198 | 202 | 207 |
| 982 | 211   | 216 | 220 | 224 | 229 | 233 | 238 | 242 | 247 | 251 |
| 983 | 255   | 260 | 264 | 269 | 273 | 277 | 282 | 286 | 291 | 295 |
| 984 | 300   | 304 | 308 | 313 | 317 | 322 | 326 | 330 | 335 | 339 |
| 985 | 344   | 348 | 352 | 357 | 361 | 366 | 370 | 374 | 379 | 383 |
| 986 | 388   | 392 | 396 | 401 | 405 | 410 | 414 | 419 | 423 | 427 |
| 987 | 432   | 436 | 441 | 445 | 449 | 454 | 458 | 463 | 467 | 471 |
| 988 | 476   | 480 | 484 | 489 | 493 | 498 | 502 | 506 | 511 | 515 |
| 989 | 520   | 524 | 528 | 533 | 537 | 542 | 546 | 550 | 555 | 559 |
| 990 | 564   | 568 | 572 | 577 | 581 | 585 | 590 | 594 | 599 | 603 |
| 991 | 607   | 612 | 616 | 621 | 625 | 629 | 634 | 638 | 642 | 647 |
| 992 | 651   | 656 | 660 | 664 | 669 | 673 | 677 | 682 | 686 | 691 |
| 993 | 695   | 699 | 704 | 708 | 712 | 717 | 721 | 726 | 730 | 734 |
| 994 | 739   | 743 | 747 | 752 | 756 | 760 | 765 | 769 | 774 | 778 |
| 995 | 782   | 787 | 791 | 795 | 800 | 804 | 808 | 813 | 817 | 822 |
| 996 | 826   | 830 | 835 | 839 | 843 | 848 | 852 | 856 | 861 | 865 |
| 997 | 870   | 874 | 878 | 883 | 887 | 891 | 896 | 900 | 904 | 909 |
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| 999 | 957   | 961 | 965 | 970 | 974 | 978 | 983 | 987 | 991 | 996 |











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